FILING INSTRUCTIONS

File this document in the binder

- RAD: BuckyDiagnost SYSTEM MANUAL
- URF: DuoDiagnost SYSTEM MANUAL
- URF: OmniDiagnost SYSTEM MANUAL

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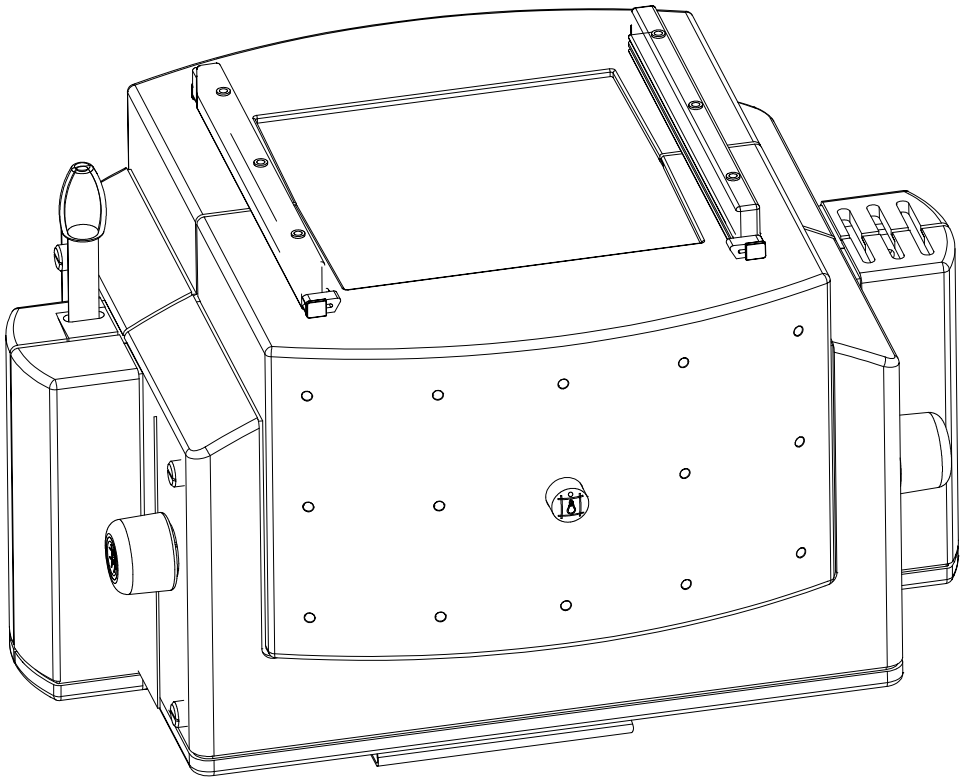
SERVICE MANUAL

NICOL X-Ray Beam Limiting Device
9896 010 2216.
9896 010 2217.
9896 010 2223.
9896 010 2224.

For serial numbers, see list of pages and drawings.



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SERVICE MANUAL - UNIT: NICOL X-Ray Beam Limiting Device

SYSTEM:

TYPE NO:.	9896 010 2216.	NICOL RAD V2 Collimator
	9896 010 2217.	NICOL DuoD V2 Collimator
	9896 010 2223.	NICOL DuoD+iris V2 Collimator
	9896 010 2224.	NICOL OmniD V2 Collimator

Manual Code Number 4522 981 03586 Date: 17-03-2004

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1 INTRODUCTION AND TECHNICAL DATA

1.1 INTRODUCTION

This X-Ray Beam Limiting Device (BLD) is suitable for:

- RAD application 9896 010 2216. successor of 9896 010 22001
- RF applications with light and ruler 9896 010 2217. successor of 9896 010 22011
- RF applications as above plus filter and iris 9896 010 2223. successor of 9896 010 22091
- RF applications 9896 010 2224. successor of 9896 010 22101

The BLD, contains the following functions:

- Rectangular collimation, using rectangular shutters (main-, backup- and near focus shutters)
- Non rectangular collimation, using rectangular and iris shutters (iris on 9896 010 2223. and 9896 010 2224. only)
- Remotely controlled spectral filter (except for 9896 010 2217.)
- Light source (including field indication plate with crossed lines, fan and light ON button) for simulating the X-Ray Field
- Electronic Ruler (9896 010 2216.) for automatic measuring the Source Image distance
- Mechanical Ruler (9896 010 2217. and 9896 010 2223. and 9896 010 2224.) for manually measuring the Source Image distance
- Swivel range -45° to +45°, with lock position at 0°Manual control of rectangular shutters (DSC), by means of 2 continuously rotatable buttons
- Accessory Rails
- Aesthetic cover
- Plug & Play interface to X-ray tube assembly (see chapter 1.6.1 Compatibility page 9)

1.2 OPTIONS

Possible options for this BLD are:

- 9896 010 22071 transparent AEP-meter
- 4522 300 2417x NICOL DISC[1]
  downgrade to conventional interface to X-ray tube assemblies
- 4522 300 2418x NICOL P&P DISC[1]
  for upgrading of Nicol to X-ray tube assemblies with P&P interface

[1] see chapter 1.6.1 Compatibility page 9

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1.3 VERSIONS

Table 1: Version survey

Functions	9896 010 2216.	9896 010 2217.	9896 010 2223.	9896 010 2224.
Rectangular collimation	☑	☑	☑	☑
Non rectangular collimation	-	-	☑	☑
DSC buttons	☑	☑	☑	☑
Remote Controlled Spectral Filter	☑	-	☑	☑
Light/Light-button + fan + Field Indication Plate	☑	☑	☑	☑
Electronic Ruler	☑	-	-	-
Mechanical Ruler	-	☑	☑	☑
Swivel	☑	☑	☑	☑
Accessory rail	☑	☑	☑	☑
Aesthetic cover	☑	☑	☑	☑
Option: AEP-meter transparent	☑	☑	☑	☑

1.4 EQUIPMENT IDENTIFICATION AND LABELLING

The BLD identification labels are located at the rear of the BLD, see item 1, Figure 31, page 49.

1.5 TOOLS

For software tools see the applicable system reference manual. For hardware tools, see chapter 2.1.1, Tools & Test Equipment, page 16.

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1.6 TECHNICAL DATA

1.6.1 COMPATIBILITY

The BLD is compatible with:

X-Ray tube assemblies indicated in Table 3 in combination with NICOL Beam Limiting Devices as configured in

- Table 2.

Table 2: Nicol configurations

Nicol Configurations		With service kit		
Nicol RAD Nicol DuoD Nicol DuoD+iris Nicol OmniD	9896 010 22001 9896 010 22011 9896 010 22091 9896 010 22101	None		A
		NICOL P&P DISC	4522 300 2418x	B
Nicol RAD V2 Nicol DuoD V2 Nicol DuoD+iris V2 Nicol OmniD V2	9896 010 2216. 9896 010 2217. 9896 010 2223. 9896 010 2224.	None		C
		NICOL DISC	4522 300 2417x	D

Table 3: Compatibility Overview

X-ray tube assembly				NICOL configuration
Tube		Housing	12nc	
MRC	200 0310	ROT-GS 1004	9890 000 85091	A, D
			9890 000 85092	B, C
MRC	200 0407	ROT-GS 1004	9890 000 85101	A, D
			9890 000 85102	B, C
MRC	200 0508	ROT-GS 1003	9890 000 85141	A, D
			9890 000 85142	B, C
MRC	200 0508	ROT 1003	9890 000 85131	A, D
			9890 000 85132	B, C
MRM	0410	ROT-GS 2502	9890 000 63271	A, D
			9890 000 63272	B, C
MRM	0508	ROT-GS 2502	9890 000 63261	A, D
			9890 000 63262	B, C
SRM	0608	ROT-GS 505	9890 000 85181	A, D
			9890 000 85182	B, C
SRM	0511	ROT-GS 501	9890 000 03821	A, D
			9890 000 03822	B, C
SRM	0612	ROT 501	9890 000 63911	A, D
			9890 000 63912	B, C
SRO	33100	ROT 351	9874 006 23112	A, D
			9890 000 85851	B, C
SRO	33100	ROT 350	9874 005 16122	A, D
			9890 000 85841	B, C
SRM	2250	ROT-GS 500	9890 000 03841	A, D
			9890 000 03842	B, C
SRM	2250	ROT-GS 504	9890 000 63841	A, D
			9890 000 63842	B, C
SRM	0612	ROT 504	9890 000 85001	A, D
			9890 000 85002	B, C
SRO	2550	ROT 350	9874 004 23122	A, D
			9890 000 85831	B, C
SRO	0951	ROT 350	9890 000 63181	A, D
			9890 000 63182	B, C
RO	1648	ROT 350	9890 000 85301	A, D
			9890 000 85302	B, C
RO	1750	ROT 350	9890 000 85281	A, D
			9890 000 85282	B, C

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- Bucky Diagnost TH and Digital Diagnost for 9896 010 2216.
- Duo Diagnost for 9896 010 2217. and 9896 010 2223.
- Omni Diagnost Eleva for 9896 010 2224.
- CAN-CMS CIA (ISO-CAN 2a) standard

NOTE

The compatibility list is subject to change without notice!

1.6.2 MECHANICAL DATA

- tube housing interface : standard BLD coupling flange
- BLD coupling flange -focus distance : 64mm
- Dimensions and Weight : see Table 4

Table 4: Dimensions and weight

	9896 010 2216.	9896 010 2217.	9896 010 2223.	9896 010 2224.
Dimensions (lxwxh)	38.2 x 28.2 x22.4 [cm^3]			
Packing dimensions	52 x 42 x 35 [cm^3]			
Net weight	± 130N		± 140N	
Gross weight	± 160N		± 170N	

1.6.3 ELECTRICAL DATA

- Power Supply interface : LA2X2 (see Table 5: Power Supply Interface)
- Control interface : LA2X1/LA2X11 (see Table 6: CAN Interface)
- protective earth interface : LAX100

Table 5: Power Supply Interface

LA2X2	Mnemonic	Description	Specification
1	+24V	+24V	24V DC ± 20%
2	0V24	0V of +24V	1.5A
3	+12V	+12V	12.0V DC ± 0.1V
4	0V12	0V of +12V	8.3A 100W
	SH	Shield connected to housing	
Connector-type: 4p. Mate-N-Lock			

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Table 6: CAN Interface

LA2X1 LA2X11	Mnemonic	Description
1	-	reserved
2	CAN-L	CAN-L bus line (dominant low)
3	0VCAN	0V of CAN supply voltage
4	-	reserved
5	-	reserved
6	0VCAN	0V of CAN supply voltage
7	CAN-H	CAN-H bus line (dominant high)
8	RSTCAN	Reset-line CAN
9	+12VCAN	+12V CAN supply voltage (I_{max} = 150mA, I_{typ} = 30mA)
	SH	Shield
connector-type: LA2X1 shielded 9-pole miniature sub-D connector male LA2X11 shielded 9-pole miniature sub-D connector female		

NOTE

The electrical cables are NOT included in the delivery

1.6.4 SOFTWARE DATA

The SW is located on a single PROM, see Table 7:

Item	code number	contains	code number	Location
NICOL RAD V2	9896 010 2216.	1 prom NICOL R1.3.1	4522 166 10705	LA3D17 see Z3-3
NICOL DuoD V2	9896 010 2217.	1 prom NICOL R1.3.1	4522 166 10705	LA3D17 see Z3-3
NICOL DuoD+iris V2	9896 010 2223.	1 prom NICOL R1.3.1	4522 166 10705	LA3D17 see Z3-3
NICOL OmniD V2	9896 010 2224.	1 prom NICOL R1.3.1	4522 166 10705	LA3D17 see Z3-3

Table 7: SW overview

NOTE

The SW release is subject to changes without notification!

1.6.5 ENVIRONMENTAL CONDITIONS FOR TRANSPORT AND STORAGE

- Ambient temperature range : -25 - +70 °C
- Relative humidity : 5 - 95 %
- Atmospheric pressure range : 70 - 110 kPa

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1.6.6 PERFORMANCE DATA

Rectangular shutters

- two pairs of independent, symmetrically moving main shutters, 3mm thick lead (mechanically coupled to backup shutters and near focus shutters)
- max. aperture : 2 x 14.4° (image receptor area 510mm at SID=100cm)
- minimum field size : < 2 x 2 mm (at SID=100cm)

Iris

- 4 circular shaped iris segments, lead 3mm thick, in combination with the rectangular shutters
- max iris segment aperture : 18.8° (image receptor area 680mm at SID=100cm)
- max circular aperture : 14.4° (image receptor area 510mm at SID=100cm)
- minimum field size : 90mm (at SID=100cm)

Spectral Filter

- Remote controlled, discontinuous rotatable filter disk, containing four selectable filter positions. For filter material and thickness, see Table 8: Filter material/position assignment.
- Filter switch time : < 350 ms (for adjacent filters)
  < 700 ms (full range)

Table 8: Filter material/position assignment

Filter position	9896 010 2217.	9896 010 2216. 9896 010 2223.		9896 010 2224.	
		material	Aleq @75kV	material	Aleq @75kV
Position 0	No filter(s)	no filter	-	no filter	-
Position 1		1 mm Al + 0.1 mm Cu	4.0 mm	1 mm Al + 0.1 mm Cu	4.0 mm
Position 2		1 mm Al + 0.2 mm Cu	6.5 mm	1 mm Al + 0.2 mm Cu	6.5 mm
Position 3		2 mm Al	2.0 mm	1 mm Al + 0.3 mm Cu	11.0 mm

Light

- Light source : 12V/100W halogen lamp
- Light intensity : > 193 lux (at SID=100 cm)
- X-Ray/Light Field accuracy : < 2% of SID in two directions
  (including all X-Ray tube assembly tolerances)
  < 2.5 mm (at SID = 100 cm for BLD only)
- Contrast ratio : > 4
- Maximum duty cycle : 80%, max. on time 8 min.
- Lamp on period : 5 - 60 s (SW programmable, accuracy ±0.1s)
- Lamp switch off[2] temp. : 75°C

Ruler

- Range : 30 - 205 cm
- Accuracy : 1.4 cm (at SID=70 cm)
  : 4 cm (at SID=205 cm)
- Resolution : 1 mm

[2] When the BLD has reached a temperature of 75°C, the lamp is switched off automatically (SW-controlled). It is no longer possible to switch on the lamp, until the temperature is <75°C.

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Swivel

- Range : +/- 45°
- Accuracy : 0.1° at 0° lock position

General

- Leakage radiation : <43 cGy/hr (or < 50 mR/hr) at 100cm.
- Inherent filtration : 0.22m Al equivalent @ 75kV (spectral filter NOT included)
- Max. X-Ray tube voltage : 150 kV
- Max. X-Ray tube power : 500W (for 9896 010 2216., for any filter)
  350W (for 9896 010 2217., 9896 010 2223. and 9896 010 2224., any filter)
- Cold reset/warm reset : <30 s/<5 s

1.7 COMPLIANCE INFORMATION

Philips products comply with relevant international and national standards and laws. Information on compliance will be supplied on request by your local PMS representative, or by:

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The Netherlands

Facsimile: +31 40 276 2205

Philips products comply with relevant international and national law and standards on EMC (Electro-Magnetic Compatibility) for this type of equipment when used as intended.
Such laws and standards define both the permissible electromagnetic emission levels from equipment and its required immunity to electromagnetic interference from external sources.

- IEC 60601-1 "Medical electrical equipment. Part 1: General requirements for safety" (second edition 1988, including amendment nr. 1 (1991), amendment nr. 2 (1995))
- IEC 60601-1-2 "Medical electrical equipment. Part 1: General requirements for safety. 2. Collateral Standard: Electromagnetic compatibility - Requirements and tests" (second edition, 2001)
- IEC 60601-1-3 "Medical electrical equipment. Part 1: General requirements for safety. 3. Collateral Standard: General requirements for radiation protection in diagnostic X-ray equipment" (first edition, 1994-07)
- IEC 60601-1-4 "Medical electrical equipment. Part 1: General requirements for safety. 4. Collateral Standard: Programmable electrical medical systems" (first edition, 1996-05)
- UL 2601-1 "Medical electrical equipment, Part 1: General requirements for safety" (second edition, October 1997)
- CAN/CSA -C22.2 No. 601.1-M90 "Medical Electrical Equipment. Part 1: General requirements for safety" (November 1990, including Supplement C22.2 No. 601.1S1-94 and Amendment nr. 2 (1998))
- 21CFR, Subchapter J
- IEC 60601-2-28 "Medical electrical equipment. Part 2: Particular requirements for the safety of X-ray source assemblies and X-ray tube assemblies for medical diagnosis" (first edition, 03-1993)

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1.8 CONDITIONS OF ACCEPTABILITY

The BLD is compatible with:

- X-ray tube assemblies, which meet the requirements as specified in the table below.

Leakage Radiation	≤ 0.43 mGy/h (≤ 50mR/h) at conditions 150kV, 3mA and 100cm distance.
Values of loading factors concerning leakage radiation For RAD	<500 µSv/h at conditions 150kV, 500W, 12000 mAs/h, 100cm distance.
For DuoD/DuoD+iris/OmniD	<500 µSv/h at conditions 150kV, 350W, 8400 mAs/h, 100cm distance
Inherent Filtration	≥2.5 mm Aleq at conditions 150kV, 3mA
Distance Focus - Coupling Flange Interface Plane	64mm ± 2mm

- X-ray systems, which meet the requirements as specified in the table below.

Misalignment of the edges of the of visually defined Field with the respective edges of the X-ray Field along either the length or the width of the visually defined field.	≤ 1% of SID
Alignment of the centre of the radiographic X-ray Field with the center of the image receptor	≤ 1.5% of SID

1.9 ABBREVIATIONS AND DEFINITIONS

Abbreviation	Explanation
AEP	Area Exposure Product
Aleq	Aluminum equivalency
BLD	Beam Limiting Device
DuoD	Duo Diagnost
FRU	Field Replaceable Unit
FSE	Field Service Engineer
OmniD	Omni Diagnost
PMS	Philips Medical Systems
P&P	Plug & Play
RAD	Radiography
RF	Radiography / Fluoroscopy
SID	Source Image Distance
V2	Version 2
⏚	Protective Earth (ground)

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1.10 MANUAL HISTORY

Original Text : English

Date	Versio	Name	Reason of changes
19th June 1999	99.0	P.W.M. Sijbers	First Version
9th September 1999	99.1	P.W.M. Sijbers	
31st August 2000	00.0	P.W.M. Sijbers	
31st October 2001	01.0	P.W.M. Sijbers	
3rd December 2003	03.0	P.W.M. Sijbers	• NICOL OmniD (9896 010 2224.) added. • Chapter Conditions of Acceptability added.
17th March 2004	04.0	P.W.M. Sijbers	• Document updated due to changed PEI-numbers • Chapter “1.6.1 Compatibility” extended for new tubes and Nicol V2 • Chapter “2.2.1 Mounting the Coupling Flange Nicol V2” added

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2 INSTALLATION

2.1 INTRODUCTION

This chapter contains general instructions about the installation of the BLD. For specific information at system level, refer to the relevant system reference manual.

2.1.1 TOOLS & TEST EQUIPMENT

- Standard Service Toolkit
- BLD alignment tool, code number 4522 980 31521, available from Service Logistics Best.

2.1.2 SUPPLIED ITEMS

The BLD is delivered as part of a pre-installed system or in a single package, always containing:

- BLD (including aesthetic cover)
- Coupling flange assembly (to mount and adjust the BLD on the X-Ray tube housing)
- Four countersunk screws (M6x25mm) (used for mounting the shipping bracket to the coupling flange, also are intended to mount the coupling flange to the X-Ray tube housing)
- Service Manual (No Operator Manual supplied)

2.2 INSTALLATION INSTRUCTIONS

NOTE

Whenever replacing a BLD, no centering is required, provided the coupling flange is left on the X-Ray tube housing.

- Remove the items from the packing and check them against paragraph 2.1.2 Supplied Items, for completeness.
- Install according sequence table below

	Installation NICOL V2	Installation NICOL V2 as replacement of NICOL
1	Chapter 2.2.1	Chapter 2.2.2
2	-	Chapter 2.2.3
3	Chapter 0	Chapter 0
4	Chapter 2.2.5	Chapter 2.2.5
5	Chapter 2.2.6	Chapter 2.2.6

Table 9 Installation sequence

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2.2.1 MOUNTING THE COUPLING FLANGE ASSEMBLY NICOL V2

This chapter describes the mounting procedure in case a pre-aligned X-ray Tube Assembly is used.

- Unscrew the locking plate screw (item 5, Figure 3, page 19) from each of the two locking plates (item 1, Figure 3) and push them outwards as far as possible.
- Remove the shipping bracket (item 2, Figure 3) together with the coupling flange (item 3, Figure 3) from the BLD
- Unscrew the shipping bracket from the coupling flange (countersunk screws M6 x 25 mm must be reused to mount the coupling flange on the tube housing.)

NOTE

Check the screw required length (25 mm) in the applicable tube housing service documentation. At least 5 mm must be screwed into the tube housing.

- Place the coupling flange (item 1, Figure 1) on the X-Ray tube housing (item 2, Figure 1) with factory mounted alignment ring (item 3, Figure 1)
- Positioning the reference pin (item 4, Figure 1) to the notch (item 5, Figure 1) of the alignment ring.
- Secure it with the four countersunk screws M6 x 25 mm (item 6, Figure 1) and rings (item 7, Figure 1)
- For screw length, see note above.
- Proceed with chapter 0 page 19.

CAUTION

Never loosen lacquered screws (item 8, Figure 1*. This will ruin the factory alignment of the focus. For realignment, the X-ray Source assembly must be returned to Hamburg.*

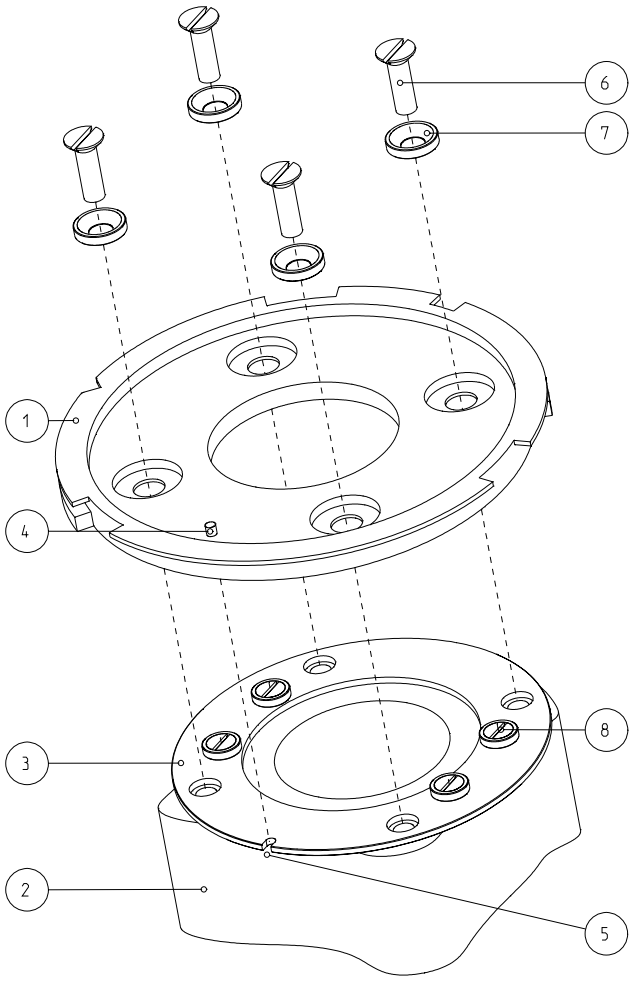

Figure 1: Mounting the P&P coupling flange

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2.2.2 MOUNTING THE COUPLING FLANGE ASSEMBLY

- Unscrew the locking plate screw (item 5, Figure 3, page 19) from each of the two locking plates (item 1, Figure 3) and push them outwards as far as possible.
- Remove the shipping bracket (item 2, Figure 3) together with the coupling flange (item 3, Figure 3) from the BLD
- Unscrew the shipping bracket from the coupling flange (countersunk screws M6 x 25 mm must be reused to mount the coupling flange on the tube housing.)

NOTE

Check the screw required length (25 mm) in the applicable tube housing service documentation. At least 5 mm must be screwed into the tube housing.

- Place the coupling flange (item 1, Figure 2) on the X-Ray tube housing (item 2, Figure 2), positioning the 0° notch (item 5, Figure 2) to the rear of the X-Ray tube housing, and secure it with the four countersunk screws M6 x 25 mm, item 3, Figure 2. (see note above)

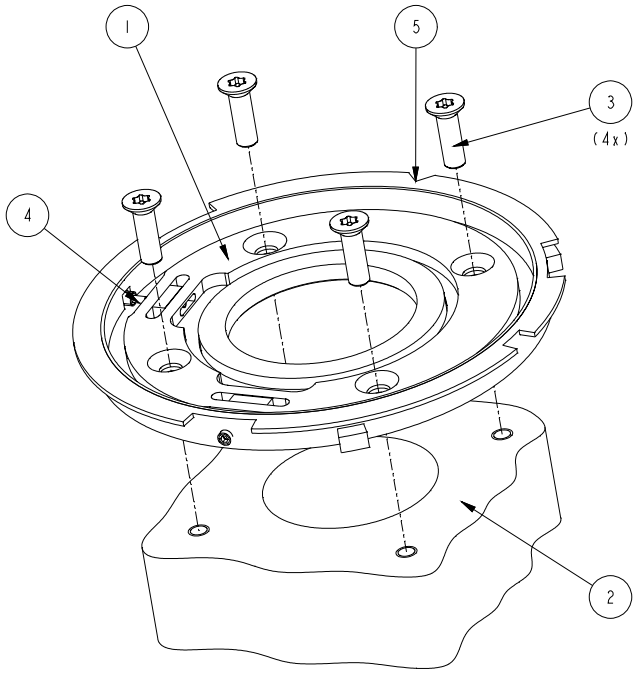

Figure 2: Mounting the coupling flange assembly

2.2.3 CENTERING THE BLD WITH RESPECT TO THE X-RAY TUBE

All BLD functions have been accurately centered in the factory, relative to the central axis; any further centering has to be done by adjusting the coupling flange assembly of the BLD with respect to the X-Ray focus. The specified alignment tool must be used.
The centering procedure is described in paragraph 6.1.4, page 40.
This procedure must be carried out:

- After replacement of NICOL DISC 4522 300 2417x
- After replacement of the X-Ray tube, configurations A and D of Table 3.
- NOT for replacements of NICOL and NICOL V2

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2.2.4 MOUNTING THE BLD ON THE X-RAY TUBE HOUSING

- Slide the two locking plates (item 1, Figure 3) outwards as far as possible.
- Mount the BLD on the coupling flange assembly, with the 0° locking mechanism (item 4, Figure 3) to slide into the notch (item 3) of the coupling flange
- Slide the two locking plates inwards to their end stop
- Secure the two locking plates to the coupling plate with the two screws (item 5)
- Check whether the BLD is properly secured

NOTE

Carefully mount the BLD to the coupling flange, in order not to DAMAGE the near focus shutters!

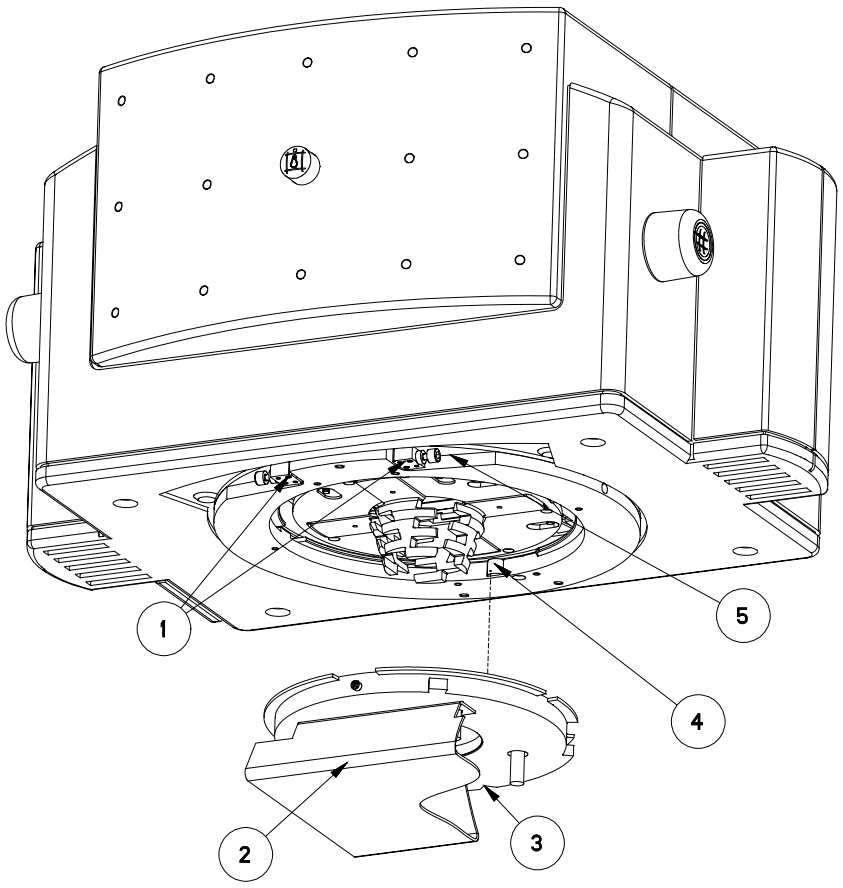

Figure 3: Mounting the BLD to the coupling flange

NOTE

It is strongly advised, to mount the BLD on the X-Ray tube housing without removing the aesthetic covers first. This allows a better grip of the heavy BLD, and prevents damage to the ruler, when lifting the BLD by holding the ruler by accident.

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2.2.5 ELECTRICAL INSTALLATION

- Mount the BLD first according chapter 0, page 19.

Removal of Aesthetic Cover

- Remove the DSC knobs (item 1, Figure 4), by pulling the knobs outward.
- Remove the accessory rails (item 2, Figure 4), by loosening the 6 screws.
- Remove the 2 screws, (item 3, Figure 4)
- Remove the two aesthetic covers (items 4 and 5, Figure 4), first lift item 4, and then lift item 5.

NOTE

When reassembling the Aesthetic covers, be sure that the ruler guidance, item 6 Figure 4 *page 20 is mounted correctly between front and rear covers.*

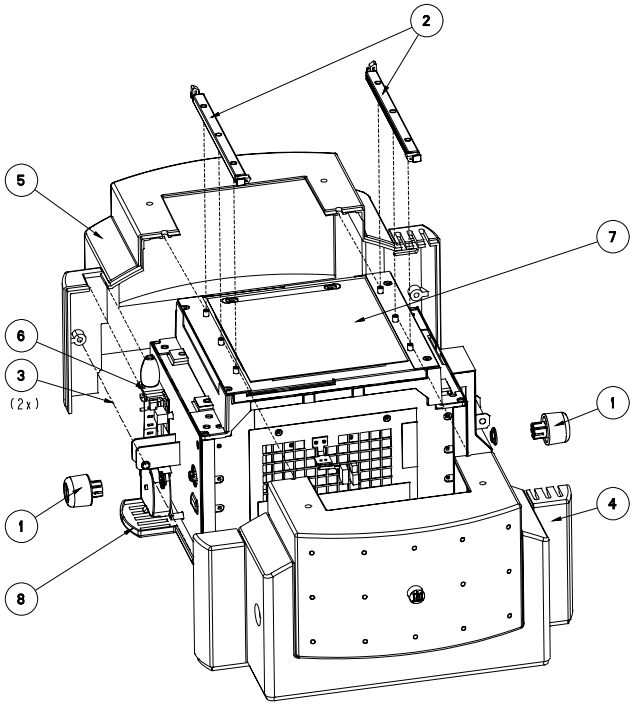

Figure 4: Remove Aesthetic Cover

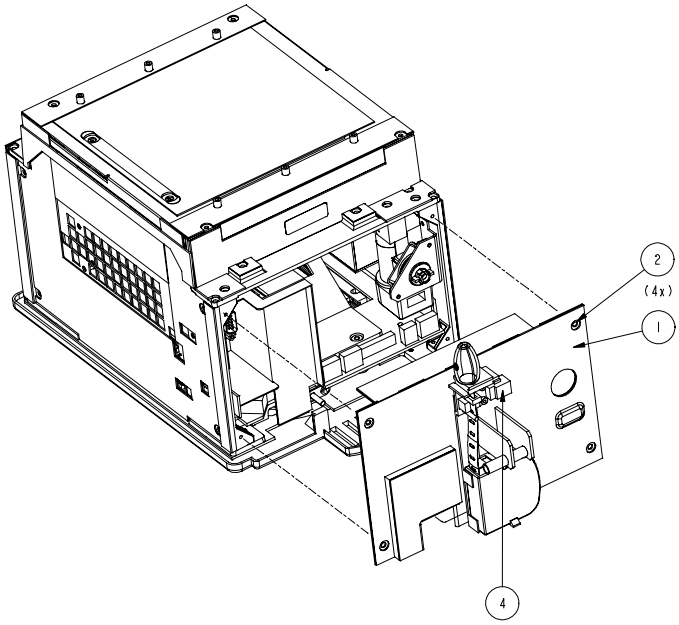

Figure 5: Remove Ruler Side Plate

Removal of Ruler Side Plate

- In case of electronic ruler (9896 010 2216.) disconnect connector LA5X1, item 4 Figure 5.
- Remove the side plate (item 1, Figure 5) using the 4 screws (items 2).

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Electrical installation

- Connect male CAN cable 9p D-connector : LA2X1 (see Figure 6)
- Connect female CAN cable 9p D-connector : LA2X11
- Connect power cable 4p Mate-N-Lock : LA2X2
- Connect yellow/green protective earth : LAX100
- Reinstall the ruler side plate
- For 9896 010 2216. only, reconnect ruler connector, LA5X1 and pay attention to proper ruler cable guidance, see chapter 0 page 34, especially Figure 15 page 34.
- Switch on the Power and check whether
  - LED LA3H1 (green) is ON
  - LED's LA3H2 (red) and are switched OFF within 30s (typical: approximately 15s).
  - LED LA3H4 (yellow) is switched OFF (time is system dependant).
- Reinstall the two aesthetic covers, including the accessory rail and DSC knobs.
- Check whether the BLD is positioned correctly in the 0°-swivel position. When trying to swivel the BLD with little force, no noticeable play may be present.

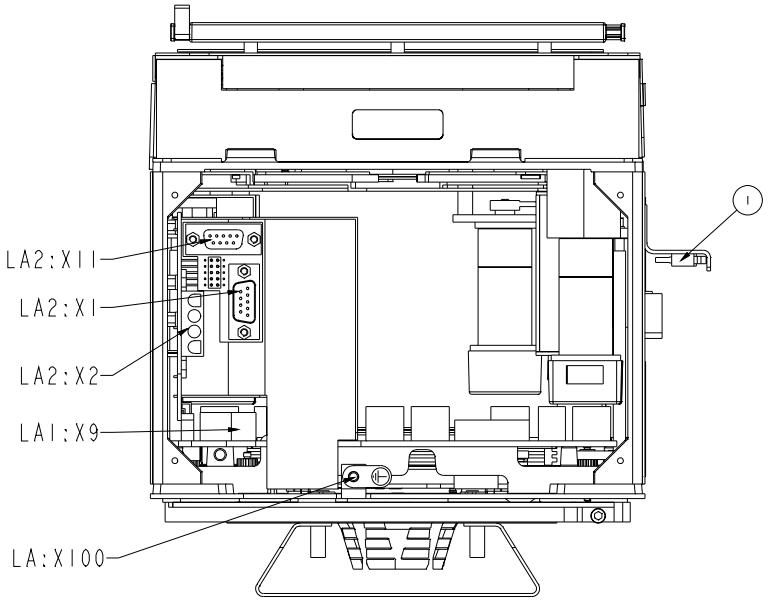

Figure 6: Electrical Installation

CAUTION

Be sure that during reinstallation of the aesthetic covers, the micro-switch for the lamp, item 1, Figure 6*, is not damaged!*

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2.2.6 CHECKING THE ALIGNMENT OF THE LIGHT FIELD AND THE X-RAY FIELD

1. Select large focus, 60 kV and 5 mAs
2. Place a loaded cassette (24 cm x 30 cm) on the table top
3. Set SID = 100 cm (Use ruler)
4. Center the X-Ray tube on the cassette
5. Place a washer (d) on the right hand-top of the cassette
6. Switch on the light and place four copper strips (c) on the edge (a) of the Light Field
7. Make an exposure
8. Develop the film
9. Measure the differences L1, L2, W1 and W2 between the outer edge of each copper strips image and the corresponding edge of the X-Ray Field (b).
10. The values L1 + L2 and W1 + W2 shall NOT exceed 2cm (representing 2% of the SID)
11. Note the measured values
12. Repeat preceding steps 1 till 11, with small focus selected.

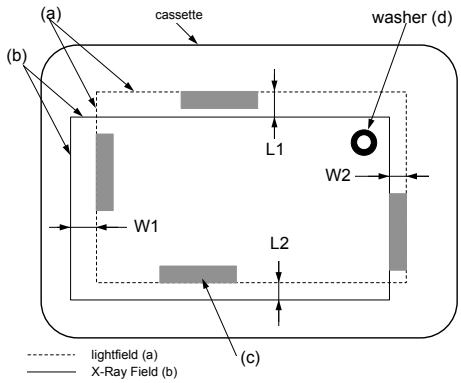

Figure 7: Check X-Ray/Light Field

The alignment procedure is described in paragraph 6.3, X-Ray Field to Light Field, page 45.

2.3 OPTIONS

2.3.1 INSTALLATION AEP-METER

It is possible to install an optional AEP-meter in the accessory rail.
For the installation we refer to:

- relevant system reference manual for removal of the aesthetic cover and
- Service manual of the AEP-meter.

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3 FAULT FINDING

NOTE

NOT described in this document, is how to find to an FRU,
based on error messages, which are sent from the BLD to the system via the CAN.
This is described in the applicable system documentation, see the relevant system reference manual.

3.1 INTRODUCTION

This chapter describes:

- indicators and measuring points for each PCB
- miscellaneous complaints and/or problems

Also for each problem, possible fault causes and/or solutions are given.

However to get feedback from the field as soon as possible, a very high FRU level is defined. So only a very limited spare parts list is available.

NOTE

In case of problems, the complete BLD has to be exchanged. The defect BLD, together with a clear problem description, has to be returned to Best as soon as possible!

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3.2 FAULTFIND STRATEGY

It is advised to start/perform faultfinding based on error messages as described in the relevant system documentation, see system reference manual. Only if this is not possible, or does not lead to a solution for the problem, this chapter may be of help. The faultfinding directly points to some basic FRU's (PCB's and BLD) and a few FRU's which are cheap and easy to replace.

3.3 INDICATORS

LED indicators are present on PCB's LA2 and LA3.
The explanation of the LED indicators is given in Table 10 and Table 11. The location of the LED's on the PCB's is given in Z3-2 to Z3-3.

3.3.1 LA2: POWER SUPPLY CONVERTER CAN INTERFACE (PSC_CAN)

Table 10: Indicators LA2

Number	Color	Description	Faultfinding and solutions
LA2H1	green	+24V present	In case H1 is OFF: • check system power supply • check cable connection from system to LA2X2 • replace LA2 • replace BLD
LA2H2	green	+5V present	In case H2 is OFF and H1 is ON: • check +24V (LA2MP1) • remove LA3, when H2 is lit now, check voltage, and if OK, replace LA3 • replace LA2 • replace BLD
LA2H3	green	+5V CAN present	• In case H3 is OFF: • check system CAN power supply • check cable connection from system to LAX1 and LAX11 • replace LA2 • replace BLD
LA2H4	green	+12V lamp present	In case H4 is OFF: • check system power supply • check cable connection from system to LA2X2 • replace LA2 • replace BLD

Refer to Z3-2 for positions on the PCB

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3.3.2 LA3: SHUTTER IRIS FILTER LIGHT CONTROLLER (SIFLCO)

Table 11: Indicators LA3

LA3H1 green [5V][3]	LA3H2 red [PCB]	LA3H3 yellow [CONHW]	LA3H4 yellow [CAN]	Faultfinding and solutions
OFF	OFF	OFF	OFF	In case H1 to H4 are OFF: • check power supply using LA2 indicators (and applicable measuring points) • replace LA2 (PSC_CAN) • replace LA3 • replace BLD
ON	ON (blinking)	OFF	ON	PCB Power On Self Test running Note: after switching on the power, the self-test is running (LED's blinking) for approximately 15 seconds.
ON	OFF	OFF	OFF	Application running
ON	OFF	*[4]	ON	No CAN communication: • check cable connection from system to LA2X1, LA2X11 • check system • replace LA2 (PSC_CAN) • replace LA3 • replace BLD
ON	OFF	ON	*	PCB connected HW defect: (use error logging at system level to identify the function and FRU that is malfunctioning) • shutter/iris/filter ⇒ replace BLD • temp sensor 1 ⇒ replace LA2 (PSC_CAN) • temp sensor 2 ⇒ replace LA3 (SIFLCO) • fan ⇒ replace fan • lamp ⇒ check cable LA2X5/LA2X6 ⇒ check LA2H4 ⇒ check whether +12V is present after power up within .... s ⇒ replace Lamp
ON	ON	OFF	OFF	PCB Power On Self Test failed • replace LA3 (SIFLCO)
ON	ON	OFF	ON	
ON	ON	ON	OFF	
ON	ON	ON	ON	PCB Power On Self Test not started or failed • no PROM, or PROM incorrectly placed • wrong HW or SW version • replace LA3 (SIFLCO)

Refer to Z3-3 for positions on the PCB

[3] [text] represents corresponding text on PCB, close to LED

[4] LED may be both ON or OFF (don't care)

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3.3.3 MEASURING POINTS

Table 12: Measuring Points

	LA1: SYBA	LA2: PSC_CAN	LA3: SIFLCO	LA5: RUCO
MP1	0V24	0V24	0V24	
MP2	+24V	+24V	+24V	
MP3	0V5	0V5	0V5	
MP4	+5V	+5V	+5V	
MP5		0V12		
MP6		LIGHT_ON	reserved	
MP7		+12V		
MP8		0VCAN		
MP9		+12VCAN		

Refer to Z3-1 to Z3-5 for the position on the PCB's

3.3.4 MISCELLANEOUS

Table 13: Miscellaneous faultfinding

Function	Fault Description	Faultfinding & Solution
Light	lamp can not be switched on via switch LAS1	• check connection LA3X5 • check lamp voltage • replace lamp • check micro-switch (Exchange micro-switch) • exchange BLD
	lamp can not be switched on via CAN	• check for CAN connection if LA3H4 is ON (see Table 11, page 8) • check lamp voltage, LA2MP6 is 12V with respect to LA2MP5 • replace lamp
	Area defined by Light Field not (completely) on film	• See 2.2.6 Checking the alignment of the light field and the X-Ray field, page 22 • Size incorrect: See chapter 6.3.1 Light Field Size Adjustment page 45 • Light Field shifted with respect to the X-Ray Field: See chapter 6.3.3 Light Field Adjustment After Replacing Lamp page 46
General	BLD does NOT function/start-up	• exchange BLD
	BLD does NOT function/start-up after replacement DSC button	• check whether the correct DSC assembly is mounted at the appropriate position
	BLD no function at all	• exchange BLD
Ruler	(electronic) ruler values NOT correct	• replace ruler, see 4.9 Replace Electronic Ruler, page 33 • Replace PCB, see 4.8 Replace LA3: SIFLCO page 32
Swivel	0° position NOT stable (to much play)	• exchange BLD

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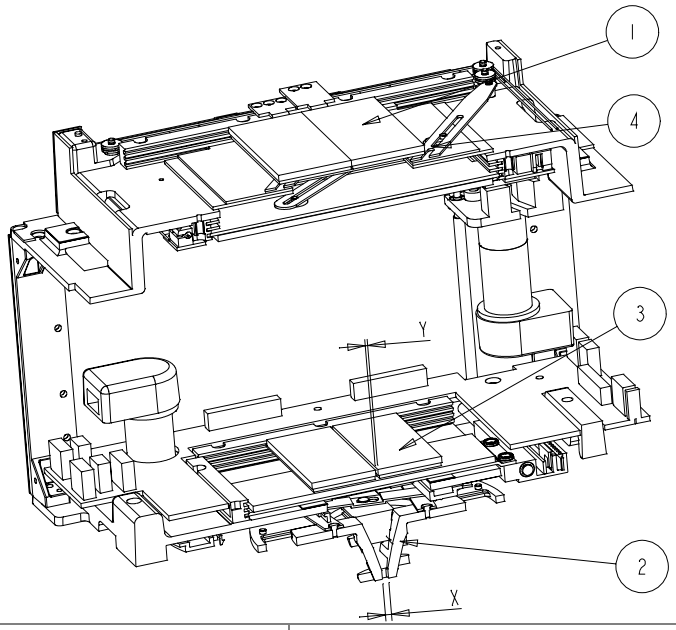
Function	Fault Description	Faultfinding & Solution
Shutters	shutters do not close completely (during start-up only)	• Backup shutters (item 3, Figure 8) or near focus shutters (item 2) close before main shutters, exchange BLD *Note:* During application shutters can NOT be fully closed.
	shadow images on exposed film	• Coupling between main shutters (item 1, Figure 8) and near focus shutters (item 2) and/or backup shutters (item 3) not correct, exchange BLD. **How to check?** 1. Switch of power 2. Fully close main shutters (item 1) manually 3. Check near focus shutter opening (item 2) 4. 3 mm ≤ x ≤ 4.4 mm 5. Check backup shutters (item 3) 6. 2.4 mm ≤ y ≤ 3.8 mm 7. Repeat steps for shutters not visible in Figure 8 • Coupling between main shutters and follow-shutters (item 4) incorrect, exchange BLD.
	Figure 8: Shutter identification and verification 	
DSC	No movement shutters when DSC knobs are rotated.	• Exchange DSC assembly. • Exchange BLD.
	Replaced DSC button does not function	• Check whether the correct DSC assembly is mounted at the appropriate position, DSC-A assembly at lamp side, DSC-B assembly at ruler side. • Check whether the DSC-A connector is correctly mounted onto LA1X16. • Check whether the DSC-B connector is correctly mounted onto LA1X6.
Spectral Filter	Filter not correctly positioned, visible in images	• Replace LA3 • Exchange BLD
		•

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4 REPLACEMENTS

4.1 GENERAL

WARNING

Never put down the BLD on near focus shutter assembly.
Use external non-metal support(s) for the BLD.

- Switch off the power, when working with the BLD!
- Never unplug connectors (LA1X7, LA1X12 and LA1X14) while power is switched on!
- Never touch lamp parts when lamp has been switched on for a long time, they may be very hot!

4.2 REPLACE (COMPLETE) BLD ON THE STAND

For replacement of the complete BLD, see also chapter 2.2 Installation instructions, page 16

1. Place the BLD and X-Ray tube housing of the Stand (if possible) in the upright down position
2. Secure the Stand!
3. Open shutters as far as possible, using the DSC buttons.
4. Switch off the power!
5. Remove the Aesthetic Cover, see paragraph 2.2.5, page 20.
6. Remove the Ruler Side Plate, see paragraph 2.2.5
7. Remove the connectors, see paragraph 2.2.5
8. Replace BLD using procedure as described in paragraph 2.2.4

WARNING

Never lift the BLD, by holding the ruler, this to prevent damage to the ruler!

4.3 REPLACE AESTHETIC COVER

The Aesthetic Cover consists of three parts, which are always delivered together. They can be replaced completely or as single parts.

1. For replacement front and/or rear cover see paragraph 2.2.5, page 20.
2. For replacement of the bottom plate see paragraph 4.14, page 38.
3. Assemble in reverse order.
4. Be sure that the ruler guidance item 6, Figure 4, page 20 is mounted correctly between the front and rear cover.
5. Check BLD for correct functioning.

4.4 REPLACE FIELD INDICATION PLATE

1. Place the BLD and X-Ray tube housing of the Stand (if possible) in the upright down position
2. Remove the Aesthetic Cover, see paragraph 2.2.5, page 20.
3. Replace the field indication plate, item 7, Figure 4, page 20.
4. Assemble in reverse order.

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4.5 REPLACE DSC BUTTONS

1. Replace the DSC buttons, items 1, Figure 4, page 20, by pulling them outwards.
2. Assemble in reverse order.

4.6 REPLACE DSC ASSEMBLY

The **DSC-A assembly** is situated **at the lamp side** whereas the ***DSC-B assembly*** is situated ***at the ruler side***. (On the flat-cable of the DSC assembly is indicated DSC-A respectively DSC-B). It is not necessary to remove the BLD from the X-Ray tube housing assembly for replacement of the DSC assemblies.

CAUTION

When the lamp has been used, the lamp and its surrounding material might be ("very") hot.

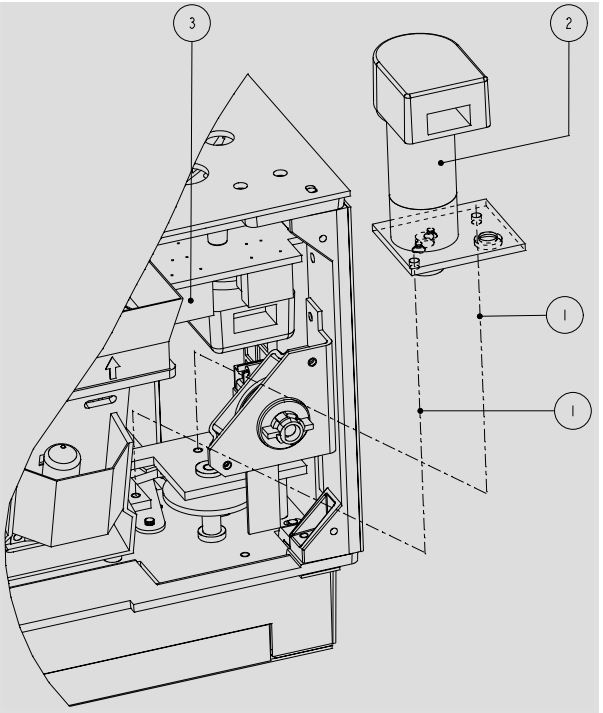

Figure 9: Removal iris motor assembly

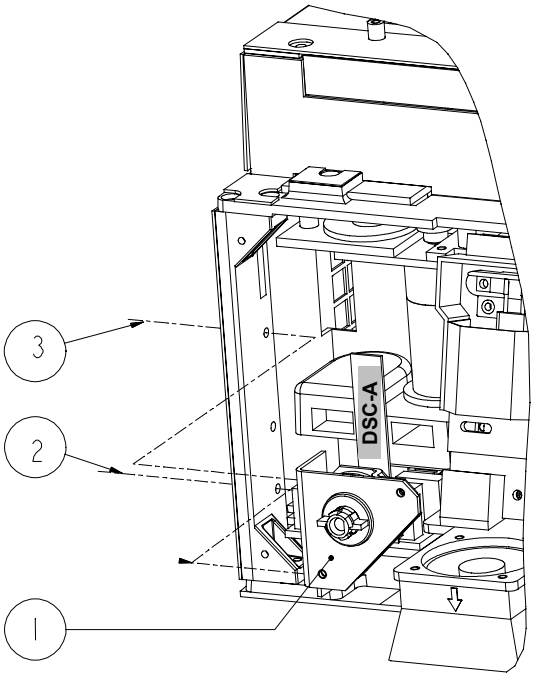

Figure 10: Replacement DSC-A assembly

Replace DSC-A assembly

1. Remove the Aesthetic Cover, see paragraph 2.2.5, page 20.
2. Be sure the power is switched OFF.
3. Remove the Lamp Side Plate, see paragraph 4.14, page 38.
4. Loosen the 2 screws, item 2 and 3, Figure 10, page 29.
5. Remove DSC-A assembly, item 1, Figure 10, page 29.
6. Remove iris motor assembly (only in case of PEI 9896 010 2223.)
   a) Disconnect connector LA1X10, item 3, Figure 9, page 29 and LA1X11.
   b) Loosen the 2 screws, both items 1, Figure 9.
   c) Remove the iris motor assembly, item 2, Figure 9.
7. Disconnect DSC connector LA1X16.
8. Replace the DSC-A assembly and reassemble (including iris motor) in reverse order.
9. Check proper functioning of the replaced DSC button after the power is switched ON

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Replace DSC-B assembly

1. Remove the Aesthetic Cover, see paragraph 2.2.5, page 20.
2. Be sure the power is switched OFF.
3. Remove the Ruler Side Plate, see paragraph 2.2.5
4. Disconnect DSC connector LA1X6.
5. Loosen the 2 screws, item 2 and 3, Figure 11, page 30.
6. Remove DSC-B assembly, item 1, Figure 11, page 30.
7. Replace the DSC-B assembly and reassemble in reverse order.
8. Check proper functioning of the replaced DSC button after the power is switched ON.

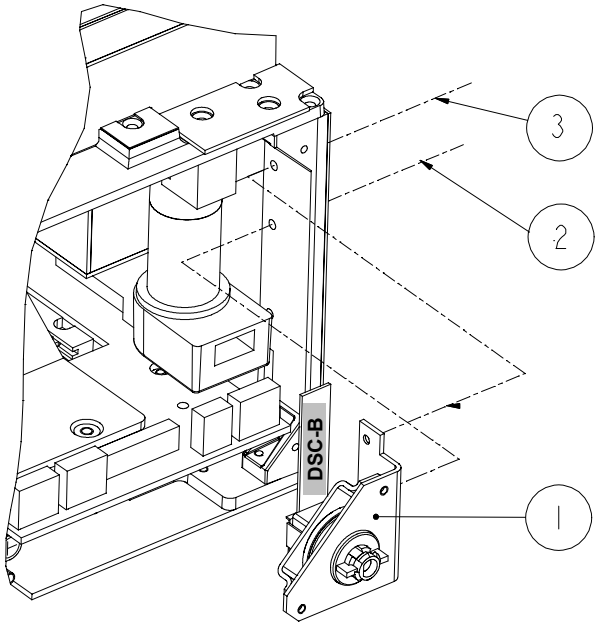

Figure 11: Replacement DSC-B assembly

WARNING

Be sure that the correct DSC assembly, see spare parts list, is mounted at the appropriate side of the BLD. If interchanged, the BLD will not start up (so no CAN connection will be established) or the DSC function will not become available.

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4.7 REPLACE LA2: PSC_CAN

1. Follow the instructions 1 - 7 of paragraph 4.2.
2. Remove the field indication plate, item 5, Figure 12
3. With Power still switched off, gently open rectangular shutters manually (Do NOT push shutters downwards)
4. Remove connectors/fastons LA2X5 and LA2X6, see item 6, Figure 12.
5. Remove the 3 screws and washers (items 1, Figure 12).
6. **A**: Pop up the board LA2 (item 2) gently and
   B: slide the board out of the BLD very carefully!
7. Re-assemble in reverse order. Be sure that the board connector (item 3) is positioned exactly in the correct position onto the backpanel connector (item 4).
8. Check correct positioning of the connectors LA2X3 / LA1X1, observe via 2 holes in the long side of the BLD (near item 4) and perpendicular to the connector via the short side of the BLD!
9. Check whether connectors/fastons LA2X5 and LA2X6, see item 6, Figure 12, are connected correctly.

WARNING

Please check and double-check whether connector LA2X3 is correctly mounted to LA1X1!!!

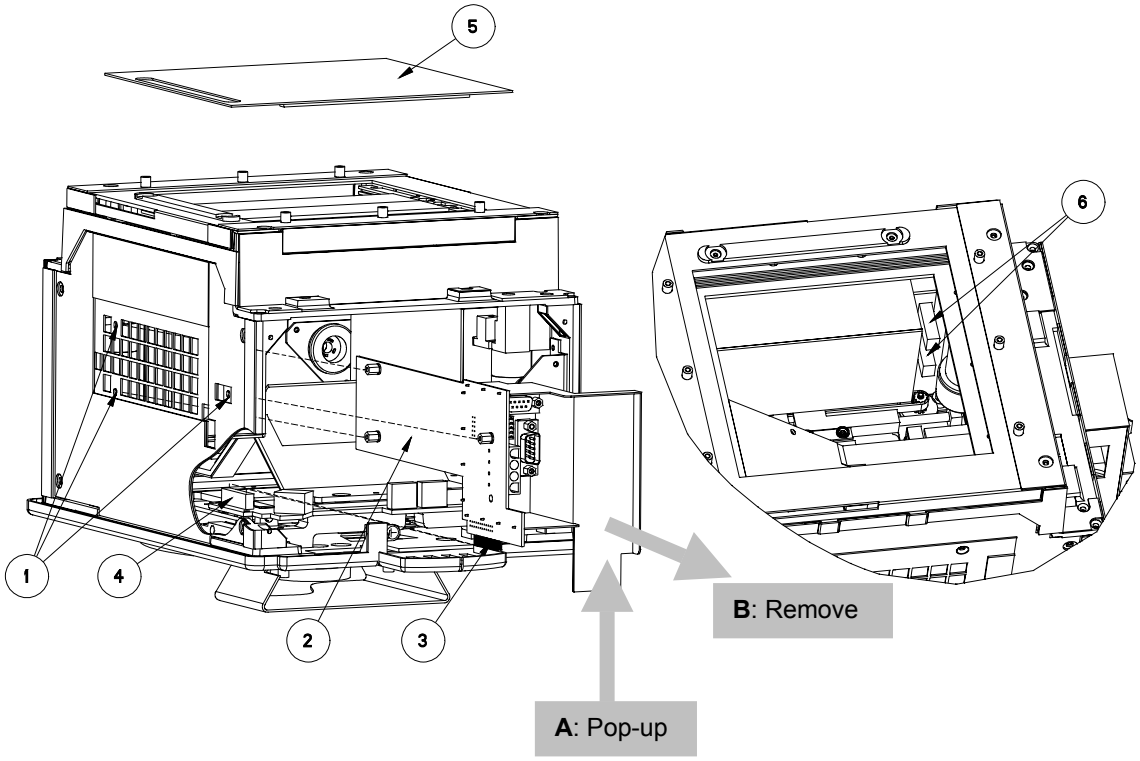

Figure 12: Replace LA2 PSC_CAN

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4.8 REPLACE LA3: SIFLCO

1. Follow the instructions 1 - 5 of paragraph 4.2.
2. Remove micro-switch connector LA3X5.
3. Remove the 4 sunken screws (items 2, Figure 13) from the LA3 Cover-plate (item 1, Figure 13) and remove the LA3 Cover-plate
4. Remove 2 screws and washers (items 4) from LA3.
5. Remove the LA3, item 3, by lifting the board (connectors LA3X1 respectively LA3X2 from LA1X3 respectively LA3X4)
6. Exchange PROM LA3D17, see 4.8.1, page 32.
7. Reassemble in reverse order. Be sure that the board connectors (item 6) are positioned exactly in the correct position onto the backpanel connectors (item 5).
8. Check correct positioning of the connectors LA3X1 respectively LA3X2 onto LA1X3 respectively LA3X4

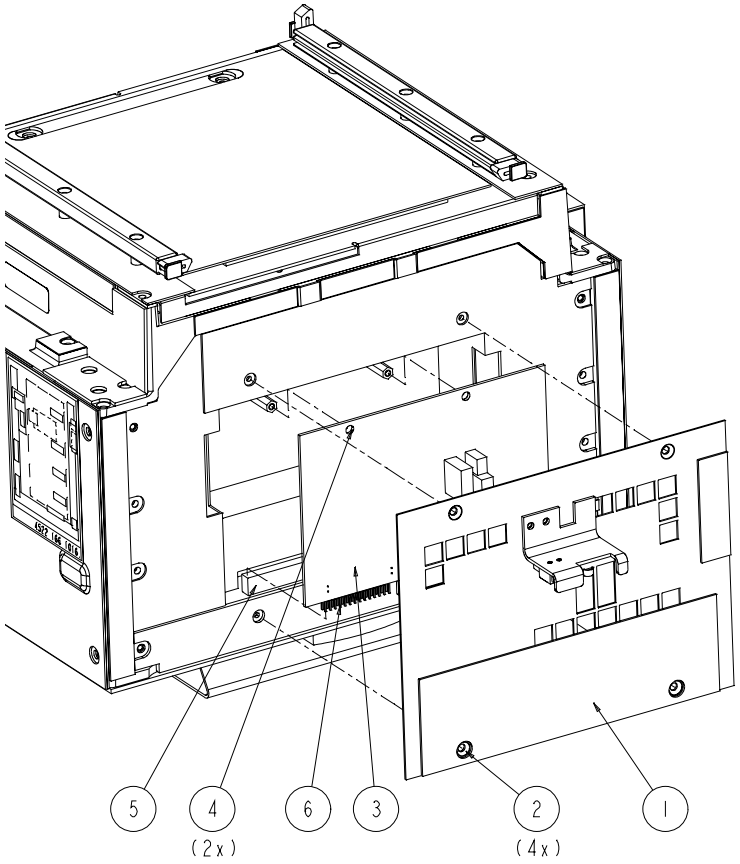

Figure 13: Replace LA3 SIFLCO

4.8.1 REPLACE PROM LA3D17

1. Follow steps 1-4 of paragraph 4.8
2. Remove PROM LA3D17 from socket, see Z3-3, by using an **appropriate IC extractor**
3. Place correct PROM into socket and check correct position, see Z3-3.
4. Reassemble in reverse order, steps 5-6 of paragraph 4.8

For safe handling of PCB's and PROM's we refer to ESD Precautions as described in Section 4: Planned Maintenance Instruction Modules (4522 983 24611 or 4535 440 04161)

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4.9 REPLACE ELECTRONIC RULER

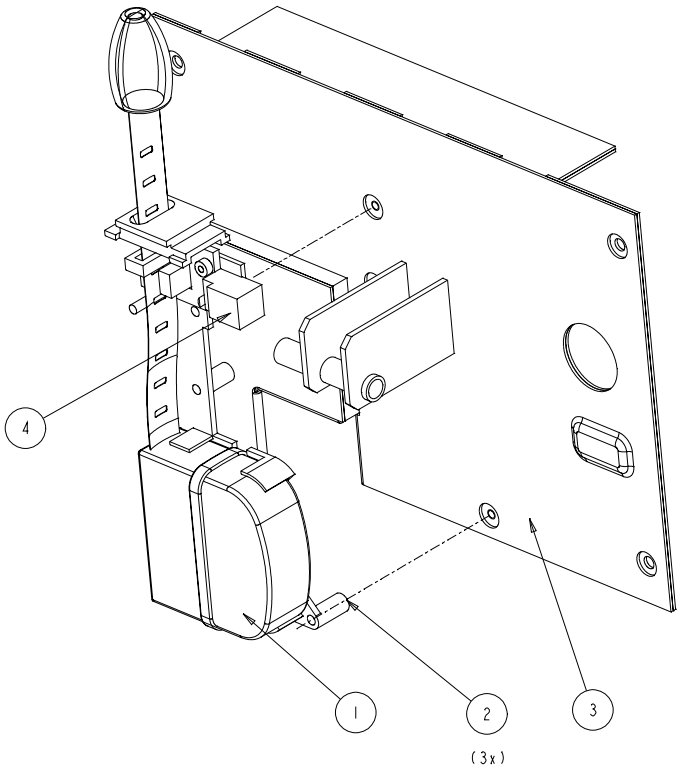

Figure 14: Replace Electronic Ruler

1. Secure the stand if necessary
2. Switch off the Power.
3. Remove the aesthetic cover, see paragraph 2.2.5, page 20.
4. Disconnect connector LA5X1 (item 4, Figure 14)
5. Remove the ruler Side-plate, see paragraph 2.2.5
6. Remove electrical ruler assembly (item 1, Figure 14) from the ruler Side-plate (item 3, Figure 14), by loosening the three screws (item 2, Figure 14)
7. Mount new electrical ruler assembly and reconnect LA5X1.
8. Check whether the ruler can be pulled out smoothly.
9. Check whether the ruler winds up completely when released.
10. Reassemble in reverse order.
11. Switch on the power again.
12. Check whether the ruler value is correctly sent to the system via CAN. See applicable system reference manual(s).

NOTE

With the aesthetic cover removed, the ruler can give incorrect values, so for the final check of the ruler, the aesthetic cover has to be mounted!

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4.9.1 CONNECTION ELECTRONIC RULER

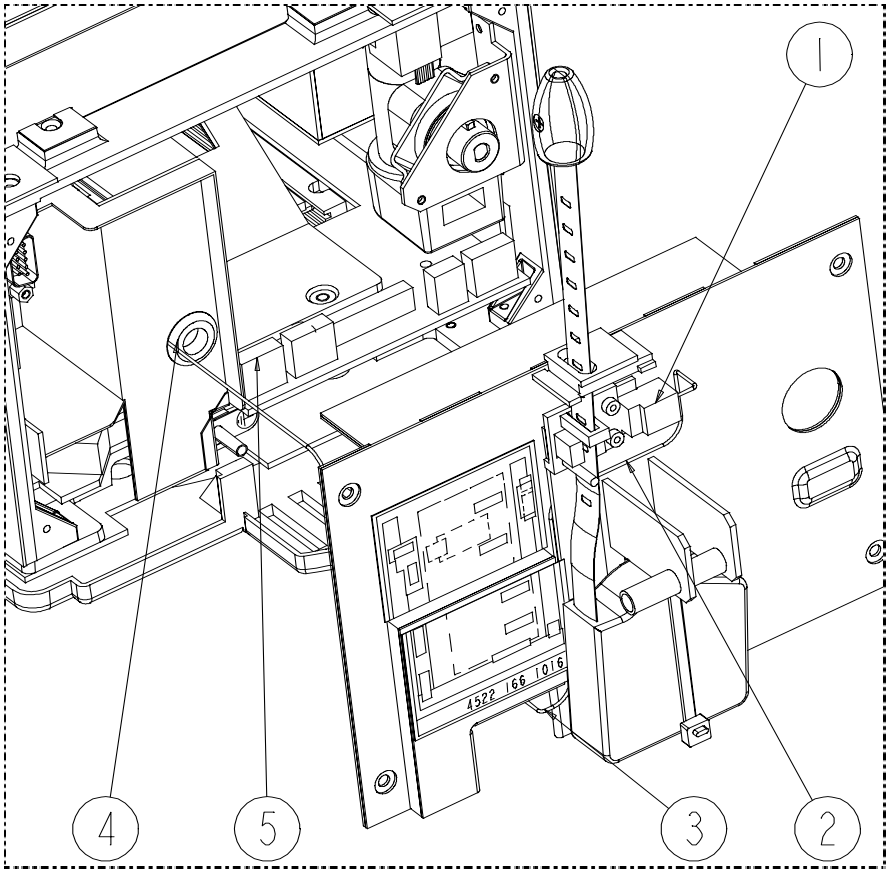

Figure 15: Connect electrical ruler cable

Figure 15 page 34 gives in more detail, the connection of the cable of the electronic ruler. In case of connection/disconnection of the electronic ruler cable, following steps have to be taken:

1. Remove ruler side plate, see chapter 2.2.5 page 20.
2. Remove connector LA1X5 (item 5 Figure 15) and cable (item 2 Figure 15). Cable must be removed by pulling connector LA5X1 (item 1 Figure 15) through the hole (item 4 Figure 15) in LA1.
3. Replace cable in reverse order
4. Mount ruler side plate, see chapter 2.2.5 page 20, while
5. Guiding ruler cable (item 3) together with power supply and CAN cable(s) through cable guidance.

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4.10 REPLACE MECHANICAL RULER

1. Remove the aesthetic cover, see paragraph 2.2.5, page 20.
2. Remove mechanical ruler assembly (item 1, Figure 16) from the ruler Side-plate (item 3, Figure 16), by loosening the three screws (item 2, Figure 16)
3. Mount new mechanical ruler assembly.
4. Check whether the ruler can be pulled out smoothly.
5. Check whether the ruler winds up when released.

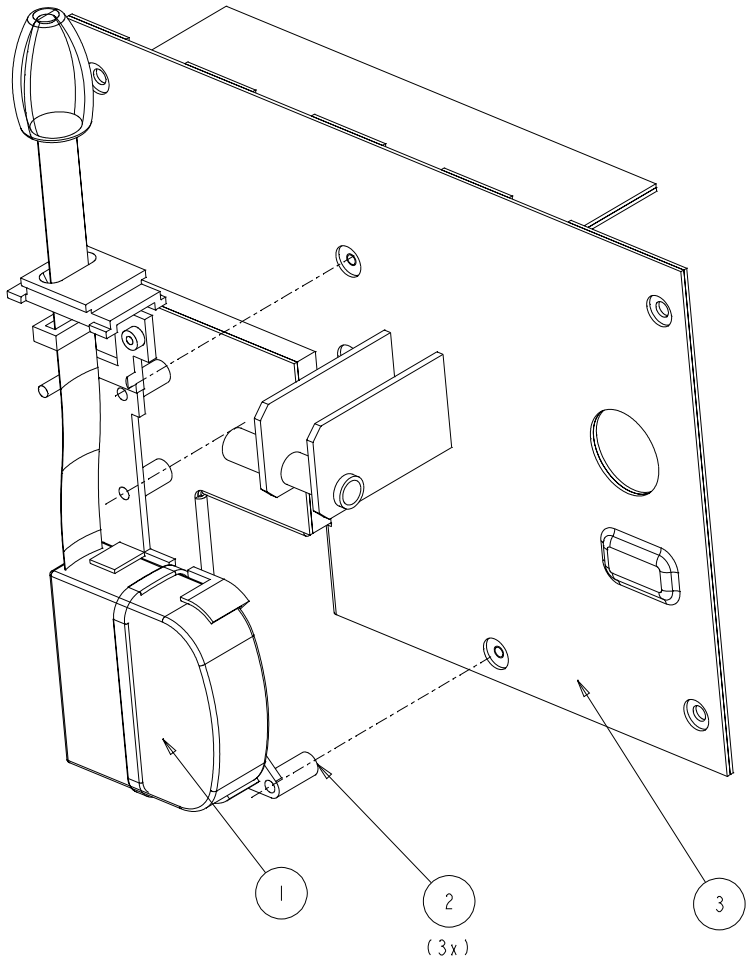

Figure 16: Replace Mechanical Ruler

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4.11 REPLACE LAMP

CAUTION

Never touch the halogen lamp with your fingers!

1. Remove the aesthetic cover, paragraph 2.2.5, page 20.
2. Remove Lamp Side Plate (item 1, Figure 17) by loosening the 4 screws (item 2, Figure 17)
3. Remove the protective cap of the lamp, item 3, Figure 18, by loosening the screw (item 4, Figure 18)
4. Remove the lamp (item 1, Figure 18) from the lamp-holder (item 2)
5. Mount the new lamp in the lamp-holder (Never touch with your fingers)
6. Check whether the lamp pins are placed in the lamp-foot as far as possible!

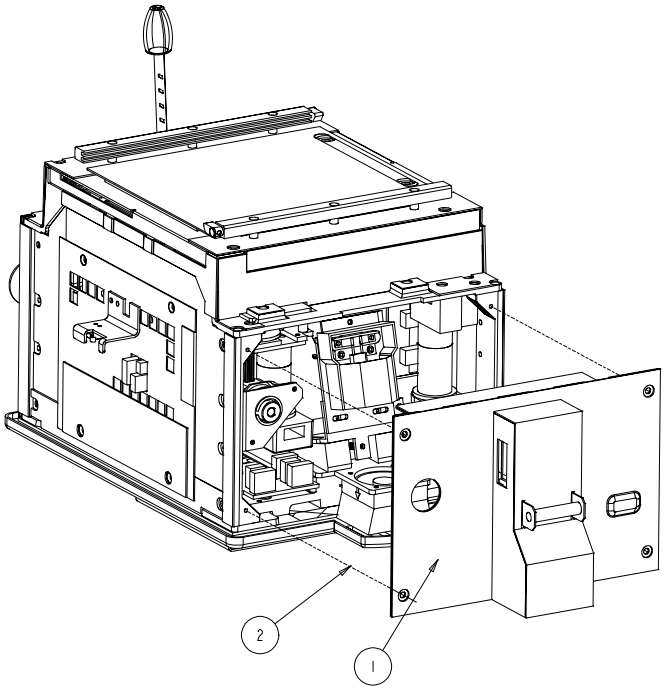

Figure 17: Remove Lamp Side Plate

7. Check the alignment of the X-Ray Field with respect to the light Field, see chapter 2.2.6 page 22.
8. Reassemble in reverse order.

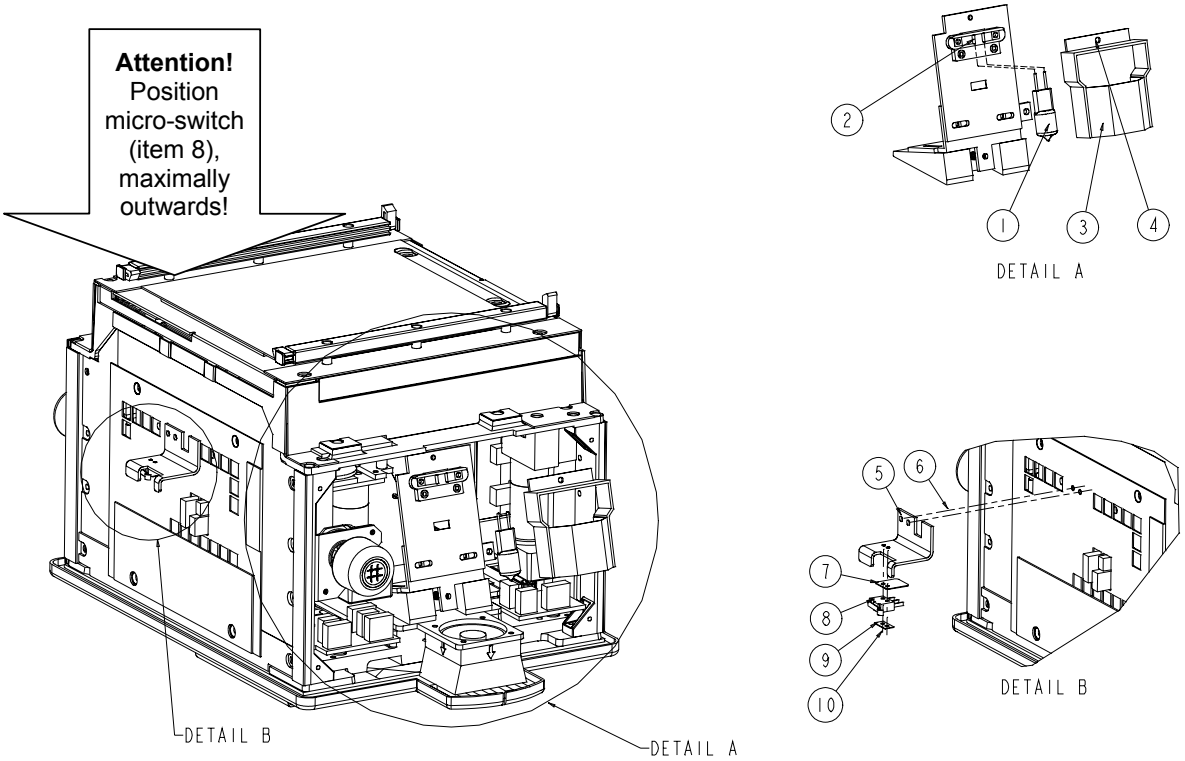

Figure 18: Replacement Lamp

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4.12 REPLACE MICRO-SWITCH

1. Remove the aesthetic cover, paragraph 2.2.5, page 20.
2. Switch Power OFF.
3. Disconnect connector LAX5.
4. Remove the micro-switch (items 6 till 10, Figure 18 page 36).
5. Replace the micro-switch (item 8, Figure 18 page 36), reusing items 5, 6, 7, 9 and 10 and re-connect LAX5. Be sure the micro-switch is positioned maximally outwards before tightening the screws.
6. Switch Power ON
7. Check proper functioning of the micro-switch.
8. Reassemble the aesthetic cover.
9. Check proper functioning of the micro-switch, with aesthetic cover reassembled.

WARNING

Maximum torque for tightening the screws items 6, Figure 18 *page* 36 = *11Ncm*

4.13 REPLACE MICRO-SWITCH INCLUDING BRACKET

1. Remove the aesthetic cover, paragraph 2.2.5, page 20.
2. Switch Power OFF.
3. Disconnect connector LAX5.
4. Remove the micro-switch including the bracket (items 5 till 10, Figure 18 page 36).
5. Replace the micro-switch including the bracket and re-connect LAX5. Be sure the micro-switch is positioned maximally outwards before tightening the screws.
6. Switch Power ON
7. Check proper functioning of the micro-switch.
8. Reassemble the aesthetic cover.
9. Check proper functioning of the micro-switch, with aesthetic cover reassembled.

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4.14 REPLACE FAN

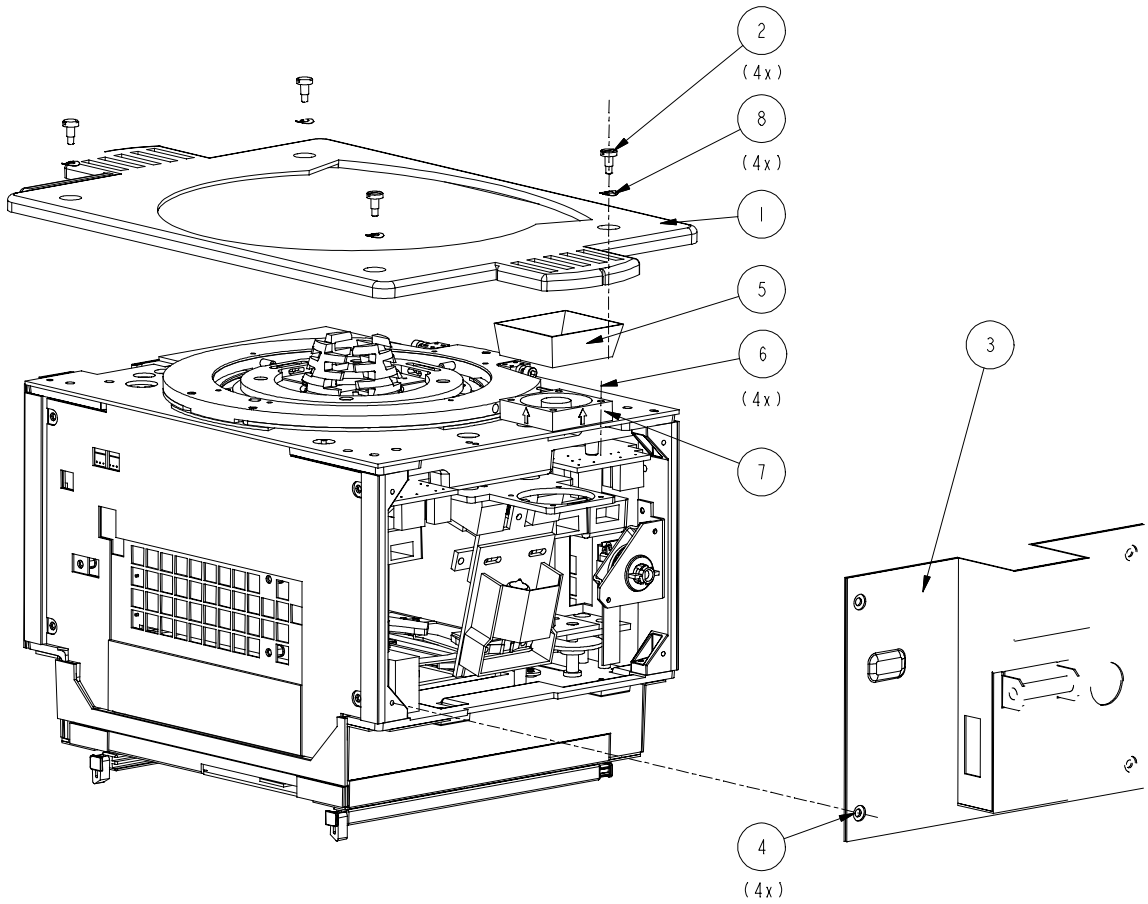

Figure 19: Replace Fan

1. Remove the BLD from the X-Ray tube assembly, see paragraph 4.2 and put BLD carefully in upright down position.
2. Remove lamp side plate, item 3, Figure 19 using the four screws (item 4, Figure 19).
3. Remove bottom plate, item 1, Figure 19 , using the four screws, item 2 and washers item 8.
4. Remove ventilation shaft, item 5, Figure 19, from fan.
5. Disconnect fan connector LA1X17.
6. Remove fan, item 7, using the four screws, item 6, Figure 19).
7. Mount new fan
8. Reassemble the BLD in reverse order.

NOTE

Items 2 have to be fixed using Loctite 243 (screw lock)

9. Check whether fan functions correctly, by switching on the lamp, using the light-button on the BLD.

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5 PROGRAMMING

5.1 INTRODUCTION

This chapter describes the jumper settings for each board. The settings of other BLD programmable functions, that must be changed with a software service tool are NOT described here, see relevant Systems reference manual.

5.2 HARDWARE PROGRAMMING

5.2.1 LA1: BACKPANEL

Table 14: Programming LA1

Jumper	Position	Description	Delivery Position
W1	1 - 2 2 - 3	BLD configured as frontal collimator (BLD1) BLD configured as lateral collimator (BLD2)	1 - 2

Refer to Z3-1 for the position on the PCB

5.2.2 LA2: POWER SUPPLY CONVERTER & CAN INTERFACE BOARD (PSC_CAN)

Table 15: Programming LA2

Jumper	Position	Description	Delivery Position
W1	1 - 2 none	BLD programmed as CAN end node BLD NOT an end node	jumper NOT mounted
W2			jumper **never** mounted!

Refer to Z3-2 for the position on the PCB

5.3 SOFTWARE PROGRAMMING

All software programming is done at system level via the CAN interface. For this purpose, we refer to the applicable system reference manual(s). Some examples of software programming at system level are:

- manual shutter speed
- shutter move limits (= radiation angle)
- BLD orientation (with respect to X-Ray tube housing)
- default Spectral Filter value
- spectral filter value assignment
- light timer settings
- default shutter position at reset

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6 ADJUSTMENTS

This procedure only to be carried out:

- After replacement of NICOL DISC 4522 300 2417x
- After replacement of the X-Ray tube, configurations A and D of Table 3.
- ***NOT*** for replacements of NICOL and NICOL V2

6.1 CENTERING THE BLD WITH THE X-RAY TUBE

6.1.1 INTRODUCTION

For perfect attachment of the BLD to the X-Ray tube housing, it is necessary that the BLD axis coincides with the median perpendicular line that passes through the center, between the two tube foci. Use BLD alignment tool, see Figure 32, page 50. Ideally, the resulted picture consists of two concentric circles. In reality there will be different pictures for small and large focus, see **Figure 22**, page 41.

6.1.2 TOOLS REQUIRED

The BLD alignment tool, code number 4522 980 31521

6.1.3 MOUNTING THE BLD ALIGNMENT TOOL

The BLD alignment tool can be mounted:

- if the coupling flange assembly is not mounted, first perform this procedure as described in paragraph 2.2.2, page 18.
- if the coupling flange assembly is mounted, similar procedure as for BLD mounting, see paragraph 0, page 19.

6.1.4 CHECKING THE CENTERING FOR PEI 9896 010 2216.

NOTE

Mark the right hand top of the film!

To check the BLD centering relative to the X-Ray tube, proceed as follows:

1. Prepare a film cassette (with screen) oriented in the plane perpendicular to the central ray, with the edges of the film parallel to the longitudinal axis of the tube.
2. Set the following data: 65kV, 30mAs, SID=100mm (or more)
3. Make an exposure with **small** focus (SF)
   Develop the film and determine:
   - the center MA of the projection of ring A (see Figure 20)
   - the center MB of the projection of ring B (see Figure 20)
   - Draw the system coordinates on the film in the A-direction and B-direction with reference to the film edges. (the positive directions can be derived from the mark at the right-hand top of the film)
4. Measure the distances P and Q on the film
5. Make an exposure with **large** focus (LF)
   Develop the film and determine:
   - the center MA of the projection of ring A (see Figure 21)

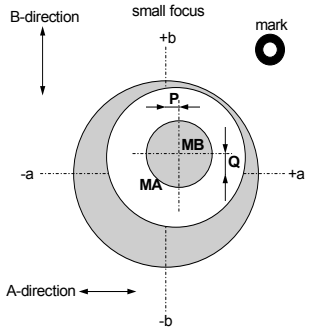

Figure 20: SF alignment

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- the center MB of the projection of ring B (see Figure 21)
- Draw the system coordinates on the film in the A-direction and B-direction with reference to the film edges. (the positive directions can be derived from the mark at the right-hand top of the film)

6. Measure the distances R and S on the film
7. The coupling flange is correctly adjusted when the film image of the small focus is a mirror image with respect to that of the large focus (see Figure 22) In this case the following applies:
   $|P| = |-R| \pm 0.3mm$
   $|Q| = |-S| \pm 0.3mm$
8. Further correction is not recommended because the adjustment can become worse due to measuring errors during the correction procedure.

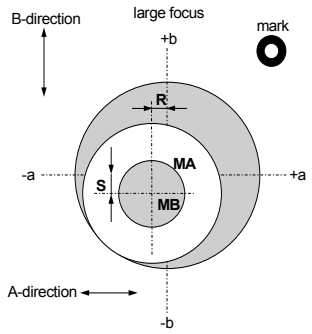

Figure 21: LF alignment

If the above tolerances have been fulfilled, remove the BLD and proceed to alignment tool as described in BLD mounting page 19. If not, paragraph 6.1.5. paragraph 0, proceed to

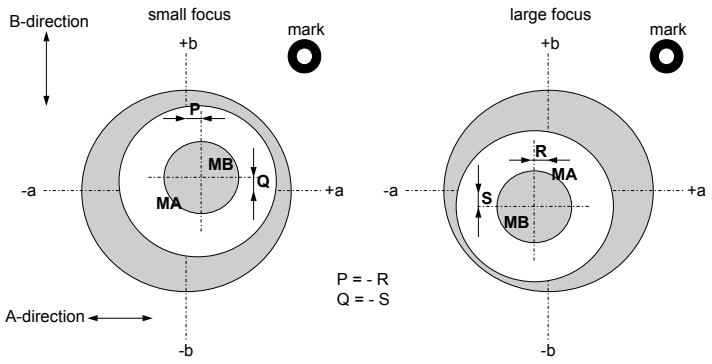

Figure 22: Requirement for alignment

6.1.5 ADJUSTING THE CENTRING

To adjust the BLD centering with the X-Ray tube, proceed as follows:

1. Measure the distances A, B, C and D (see Figure 23) and enter them as default values in Table 17 below.
2. Determine: Ta = (P + R)/2
   Ub = (Q + S)/2
   Va = Ta x Z
   Wb = Ub x Z

with the factor Z derived from the following table, depending on the selected SID:

Table 16: Z-factor

SID [mm]	1250	1100	1000	900	800	700
Z	0.40	0.46	0.50	0.55	0.62	0.70

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3. Calculate the corrected value of A, B, C and D as follows:
   Corrected A = default A + Va
   Corrected B = default B + Wb
   Corrected C = default C - Wb
   Corrected D = default D - Va
   And enter them as corrected values in Table 17 below.
4. Loosen the four coupling flange assembly countersunk screws a quarter turn.
5. Rotate the adjusting screws (Items W) to obtain the corrected values of distances A, B, C and D.
6. Tighten the four countersunk screws, taking care that the adjustment does NOT change.
7. Refer to paragraph 6.1.4 to check the centering.

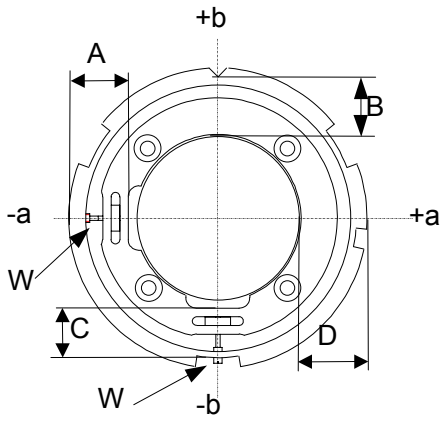

Figure 23: Adjusting the centering

Table 17: Centering correction values

	Default values	Corrected values
A		
B		
C		
D		

Example:
The following values Va = + 0.5mm and Wb = -1mm are the result of measurements and calculations.

Table 18: Centering correction values (example)

	Default values	Corrected values
A	2.5mm	3(+0.5)mm
B	3.0mm	2(-1.0)mm
C	2.5mm	2(-0.5)mm
D	3.0mm	4(+1.0)mm

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6.1.6 CHECKING THE CENTERING FOR PEI'S 9896 010 2217., 9896 010 2223. AND 9896 010 2224.

To check the BLD centering relative to the X-Ray tube, proceed as follows:

1. For details see relevant system reference manual(s)
2. Start fluoroscopy with **small** focus selected and check whether the white circle is concentric with the grey outer circle, observed on monitor.
3. If not, stop fluoroscopy and loosen the four coupling flange assembly countersunk screws, see Figure 23, page 42, a quarter turn.
4. Rotate the adjusting screws (Items W, Figure 23, page 42) in such a way, that the white circle becomes concentric with respect to the grey outer circle, observed on monitor.
   Take care of necessary X-Ray precautions!
5. Tighten the four countersunk screws, taking care that the adjustment does NOT change.
6. Check whether the alignment does not change too much, when switching to large focus. (For requirements see relevant system reference manual)

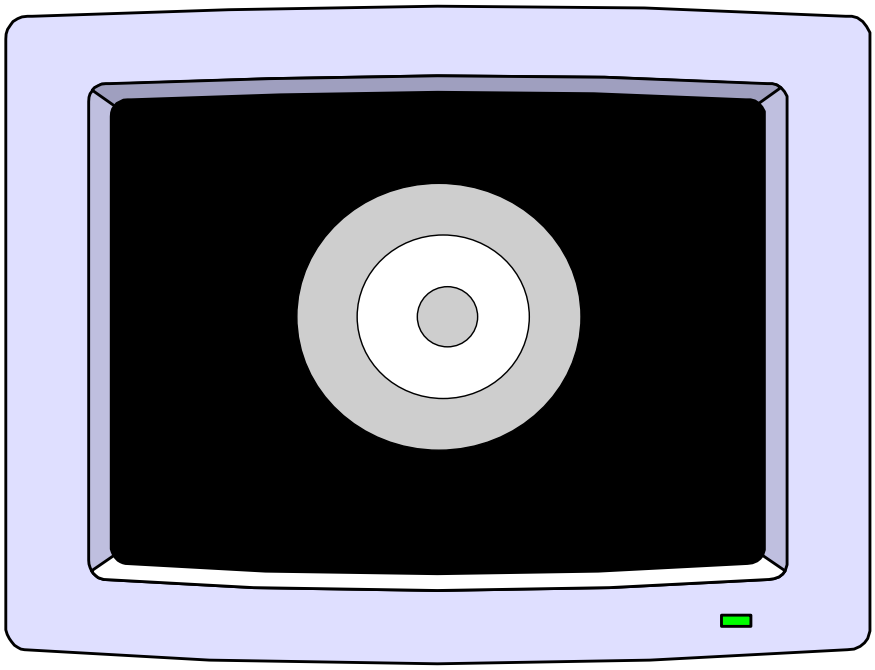

Figure 24: SF alignment during Fluoroscopy

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6.2 FIELD INDICATION PLATE WITH CROSSED-LINES

Preconditions for the Field Indication Plate adjustment:

- The X–ray field and light field should be correctly aligned.
- The output window of the BLD must be parallel to the receptor plane.
- The SID should be as large as possible (100 cm or more).
- Check whether the field indication plate is mounted correctly onto the adjusting strip, item 2 Figure 25

Procedure (refer to Figure 25*, Page 44)*

1. Close the vertical shutters (shutters A) manually, by using the corresponding DSC-button, to an opening at receptor or table, of approximately 30 mm. (lamp automatically switches on)
2. Open the horizontal shutters (shutters B) completely (use corresponding DSC-button).
3. Loosen the two screws (items 3, Figure 25) and move the adjusting strip (item 2) and the Field Indication Plate (item 1, Figure 25) so that the center of the Field Indication Plate cross-lines is parallel and within 2.5 mm of the light field center line.
4. Close the horizontal shutters to an opening at receptor or table of approximately 30 mm.
5. Open the vertical shutters (shutters A) completely.
6. Move the adjusting strip (item 2, Figure 25) and Field Indication Plate (item 1, Figure 25) so that the center of the cross of the Field Indication Plate is parallel and within 2.5 mm of the centerline of the light field.
7. Secure the adjusting strip with the two screws (items 3, Figure 25).

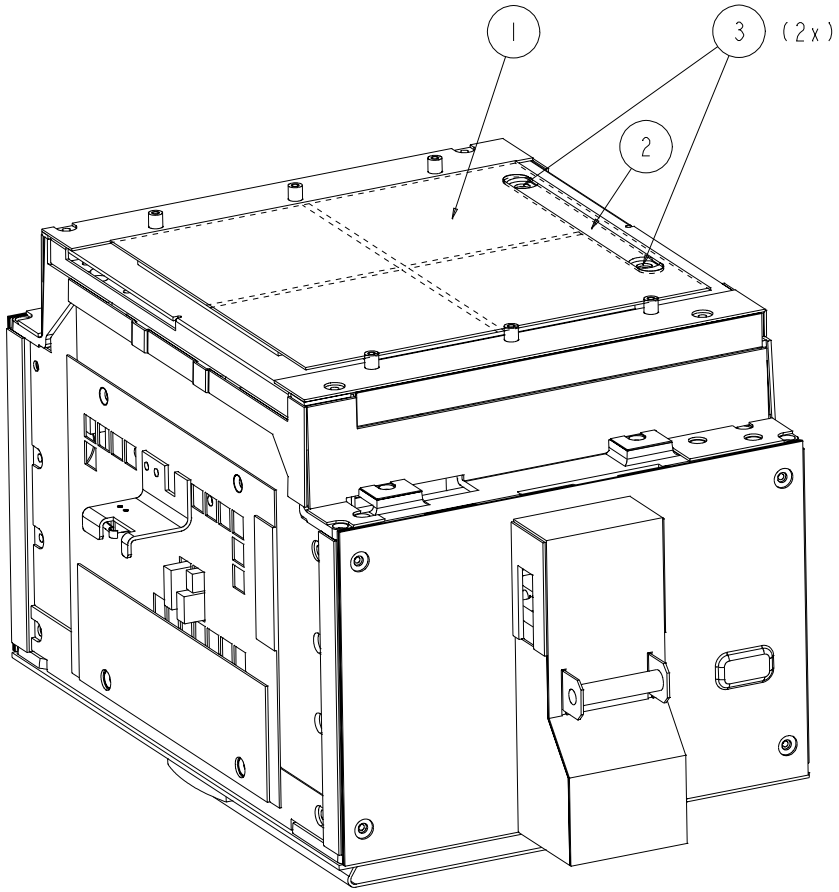

Figure 25: Adjustment Field Indication Plate

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6.3 X-RAY FIELD TO LIGHT FIELD

6.3.1 LIGHT FIELD SIZE ADJUSTMENT

This procedure must be carried out:

- if the check of the alignment of the X-Ray Field to the Light Field (chapter 2.2.6, page 22) failed

For adjustment of the size of the Light Field with respect to the X-Ray Field, the following procedure has to be used.

1. Remove aesthetic covers, see chapter 2.2.5, page 20.
2. Remove lamp side plate, see chapter 2.2.5, page 20.
3. Loosen the 2 screws, item 1, Figure 26.
4. IF Light Field > X-Ray Field THEN turn screw, item 2, Figure 26, clockwise to reduce the Light Field.
5. IF Light Field < X-Ray Field THEN turn screw, item 2, Figure 26 counter clockwise to enlarge the Light Field.
6. After completing the adjustment, tighten the 2 screws, item 1, Figure 26.
7. The adjustment must be checked according the procedure as described in chapter 2.2.6, page 22

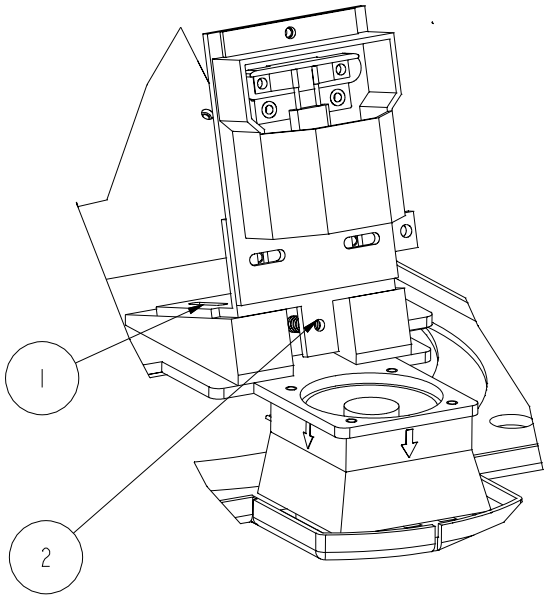

Figure 26: X-Ray Field/Light Field alignment

6.3.2 LAMP ADJUSTMENT AFTER REPLACING LAMP

This procedure only has to be carried out:

- If after replacement of the lamp, the Check the alignment of the X-Ray Field to the Light Field (chapter 2.2.6, page 22) failed because the Light Field with respect to the X-Ray Field is shifted in x direction. (Definition see Figure 29, page 46)

The following procedure is to be used:

1. After replacing the lamp, the alignment of the X-Ray Field with respect to the Light Field must be checked according the procedure as described in chapter 2.2.6, page 22
2. If not OK proceed with the following steps.
3. Remove the Field Indication Plate, item 1, Figure 25, page 44
4. Place a film (density 3) or paper on the BLD output screen.
5. Switch on the lamp
6. Look perpendicular onto the mirror and check visually, that the filaments of the lamp are correctly positioned (A = B), see Figure 27 page 45.
7. If not OK, reposition lamp (Don't touch lamp with your fingers, also lamp is getting very hot!)
8. Finally, the alignment of the X-Ray Field with respect to the Light Field must be checked again according the procedure as described in chapter 2.2.6, page 22. If not correct, repeat procedure as described in chapter 2.2.6, page 22, starting from step 6.

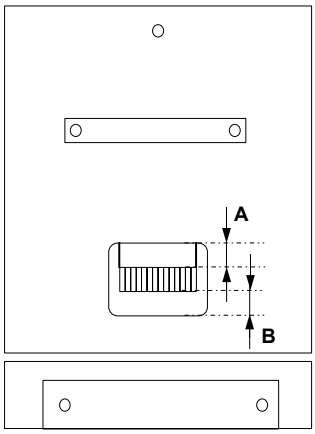

Figure 27: Lamp Adjustment

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6.3.3 LIGHT FIELD ADJUSTMENT AFTER REPLACING LAMP

This procedure only has to be carried out:

- If after replacement of the lamp, the Check the alignment of the X-Ray Field to the Light Field (chapter 2.2.6, page 22) failed because the Light Field with respect to the X-Ray Field is shifted in y direction. (Definition see Figure 29, page 46)

Swap Lamp:

1. Allow the lamp to cool down
2. Remove the lamp, do NOT touch the lamp with your fingers.
3. Reinstall the lamp, with the lamp pins switched
4. Perform Lamp Adjustment After Replacing Lamp chapter 6.3.2 page 45 .
5. Check the alignment of the X-Ray Field to the Light Field (chapter 2.2.6, page 22)

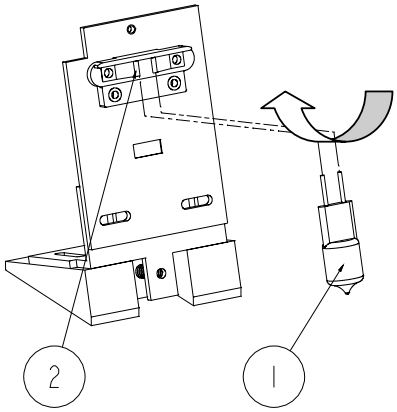

Figure 28: Swap Lamp pins

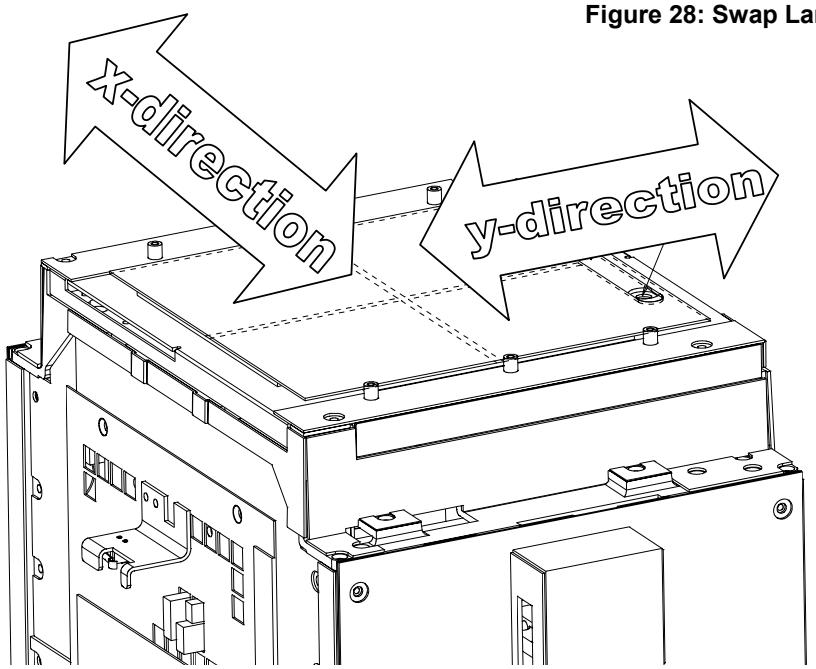

Figure 29: Definition x and y direction

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6.4 ELECTRICAL ADJUSTMENT

There are NO electrical adjustments required for the BLD.

6.5 SOFTWARE ADJUSTMENTS

All software adjustments with respect to the BLD are described in the relevant system reference manual. The BLD has NO direct service entry; this is provided by the system and described in the system reference manual. The following software adjustments with respect to the BLD are applicable:

- Focus-depth correction
- II-format adjustment

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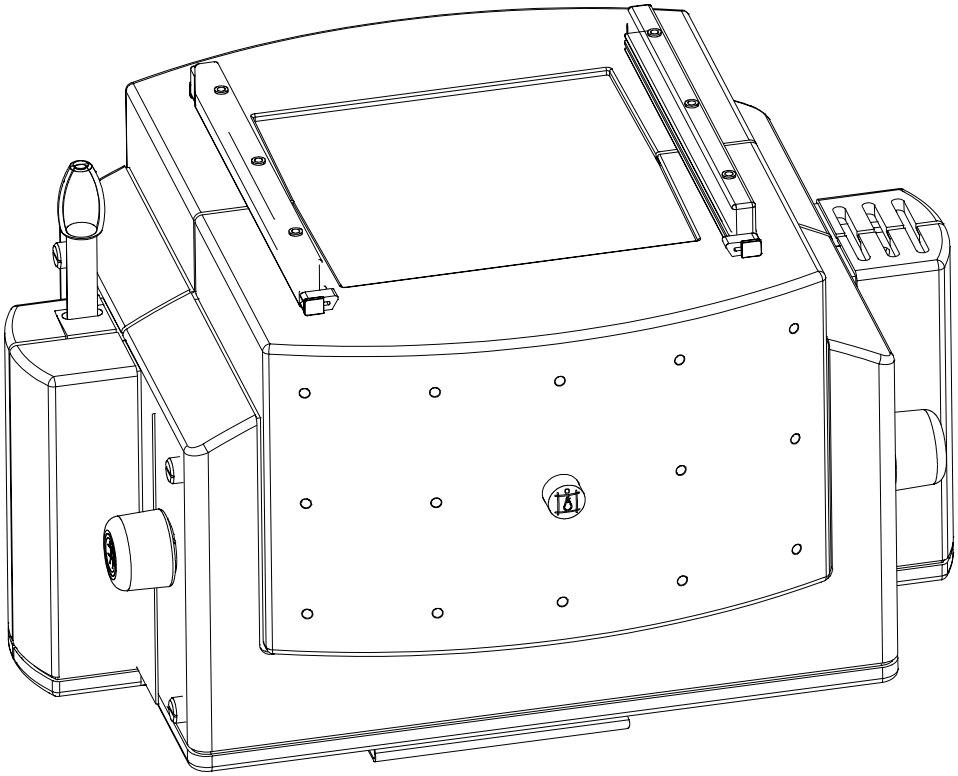

Figure 30: ITEMS SUPPLIED

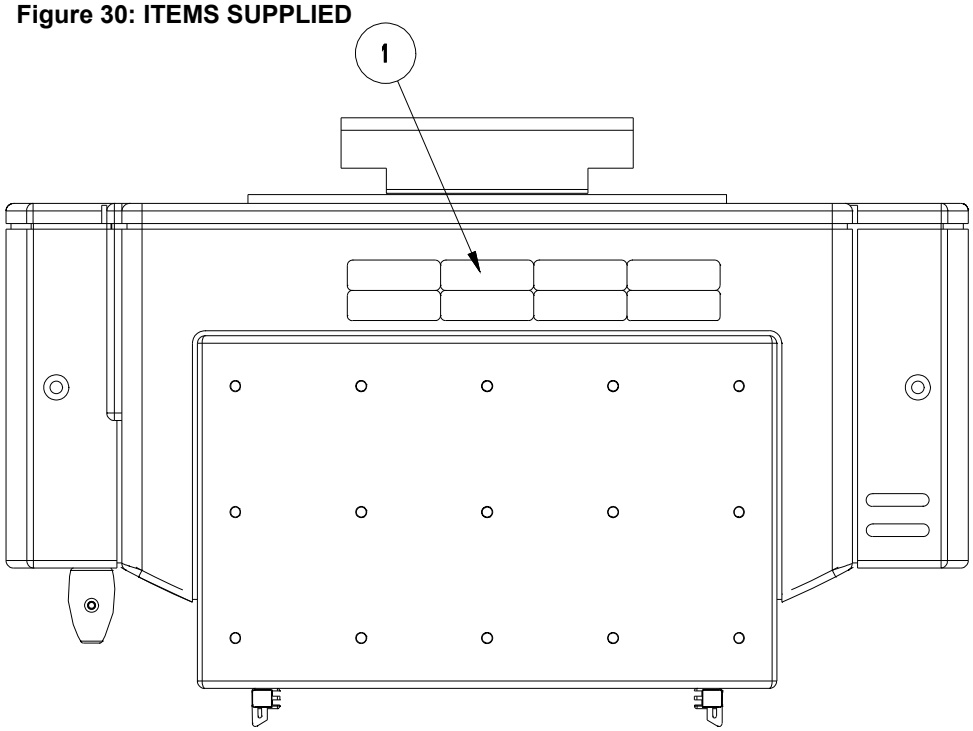

Figure 31: EQUIPMENT IDENTIFICATION

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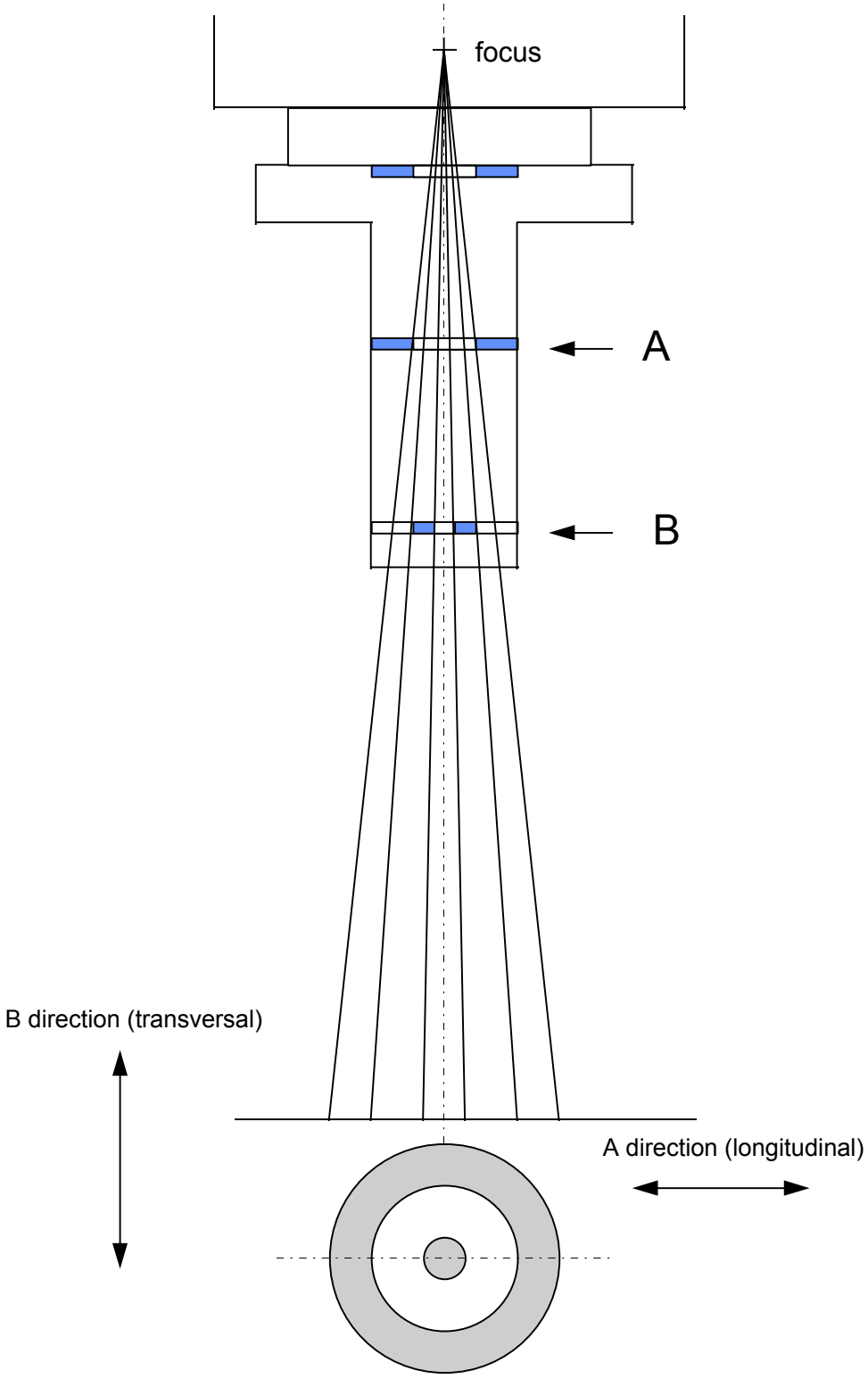

Figure 32: Alignment Tool

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P. PARTS LIST

For parts list refer to the following internet page:

http://dehsspf1.de.ms.philips.com\pms\index.html

and refer to the program Spare Parts Finder (CD-ROM)

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Z. DRAWINGS

Z1-1 SIMPLIFIED DIAGRAM POWER SUPPLIES
Z1-2 SIMPLIFIED DIAGRAM X-RAY BEAM LIMITING DEVICE
Z2-1 WIRING X-RAY BEAM LIMITING DEVICE
Z3-1 LA1 - SYSTEM BACKPANEL
Z3-2 LA2 - PSC-CAN
Z3-3 LA3 - SIFLCO
Z3-5 LA5 - RUCO

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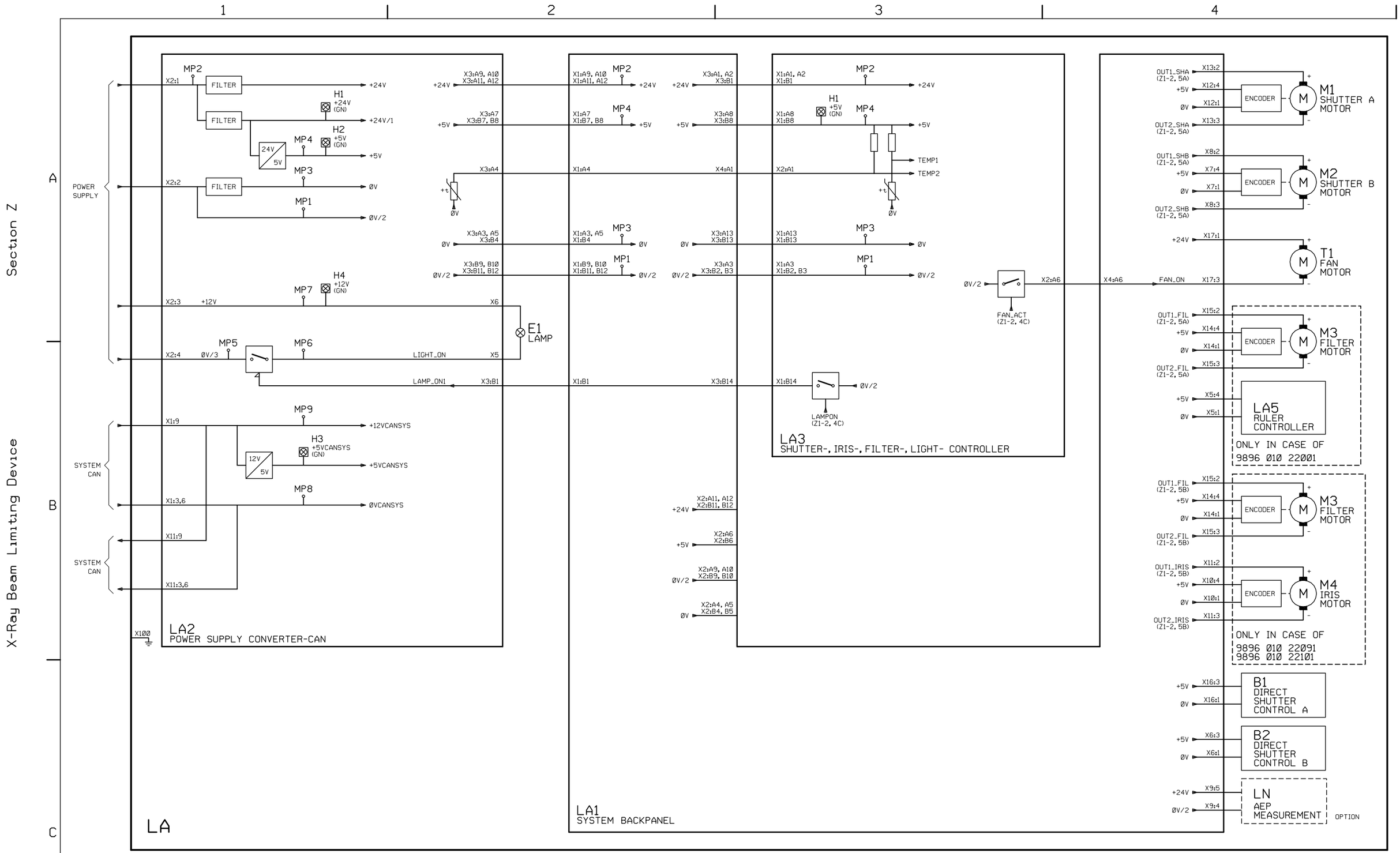
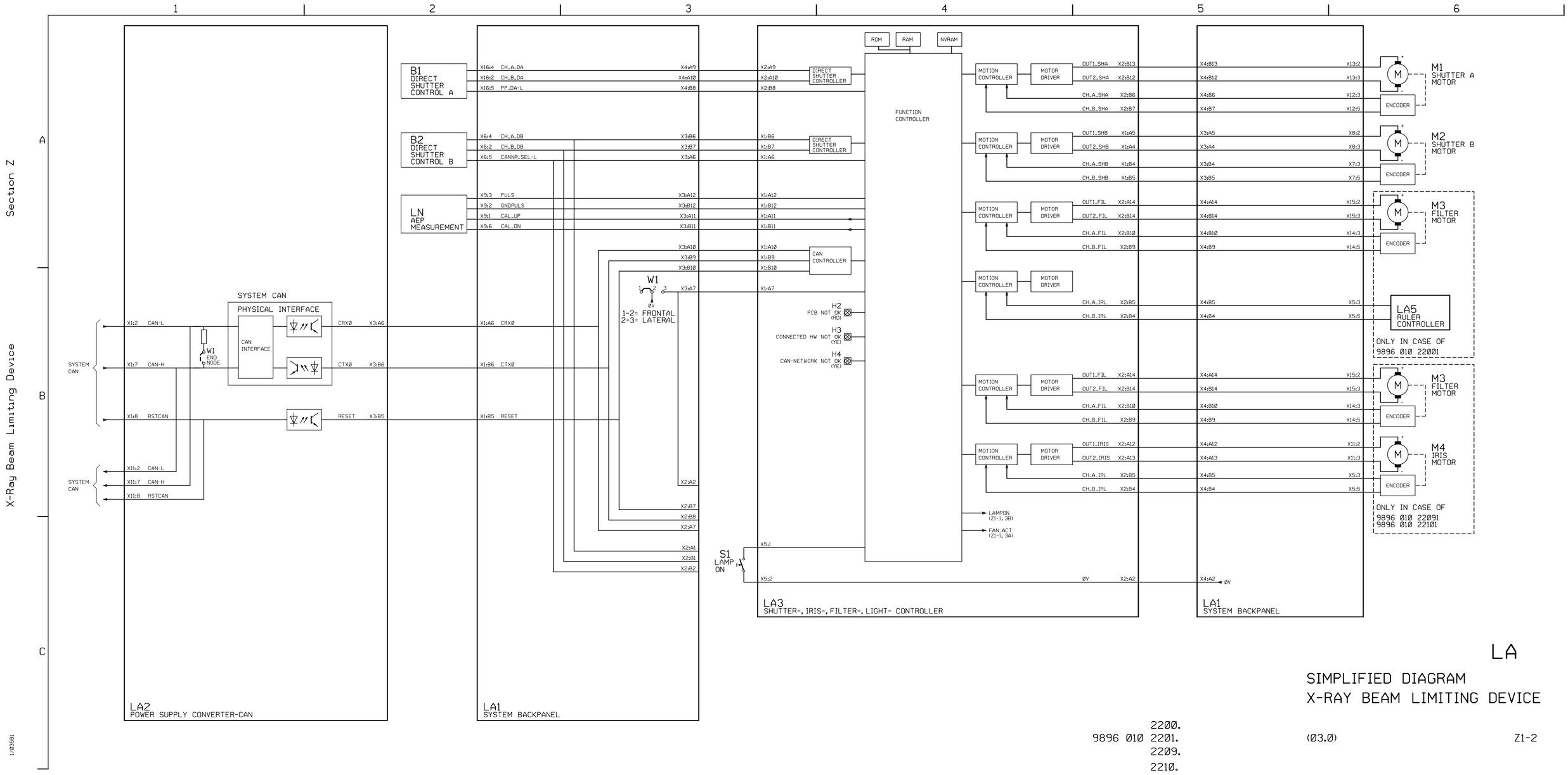


SIMPLIFIED DIAGRAM POWER SUPPLIES

9896 Ø10 2200.
2201.
2209.
2210.

(Ø3.Ø)

Z1-1



LA

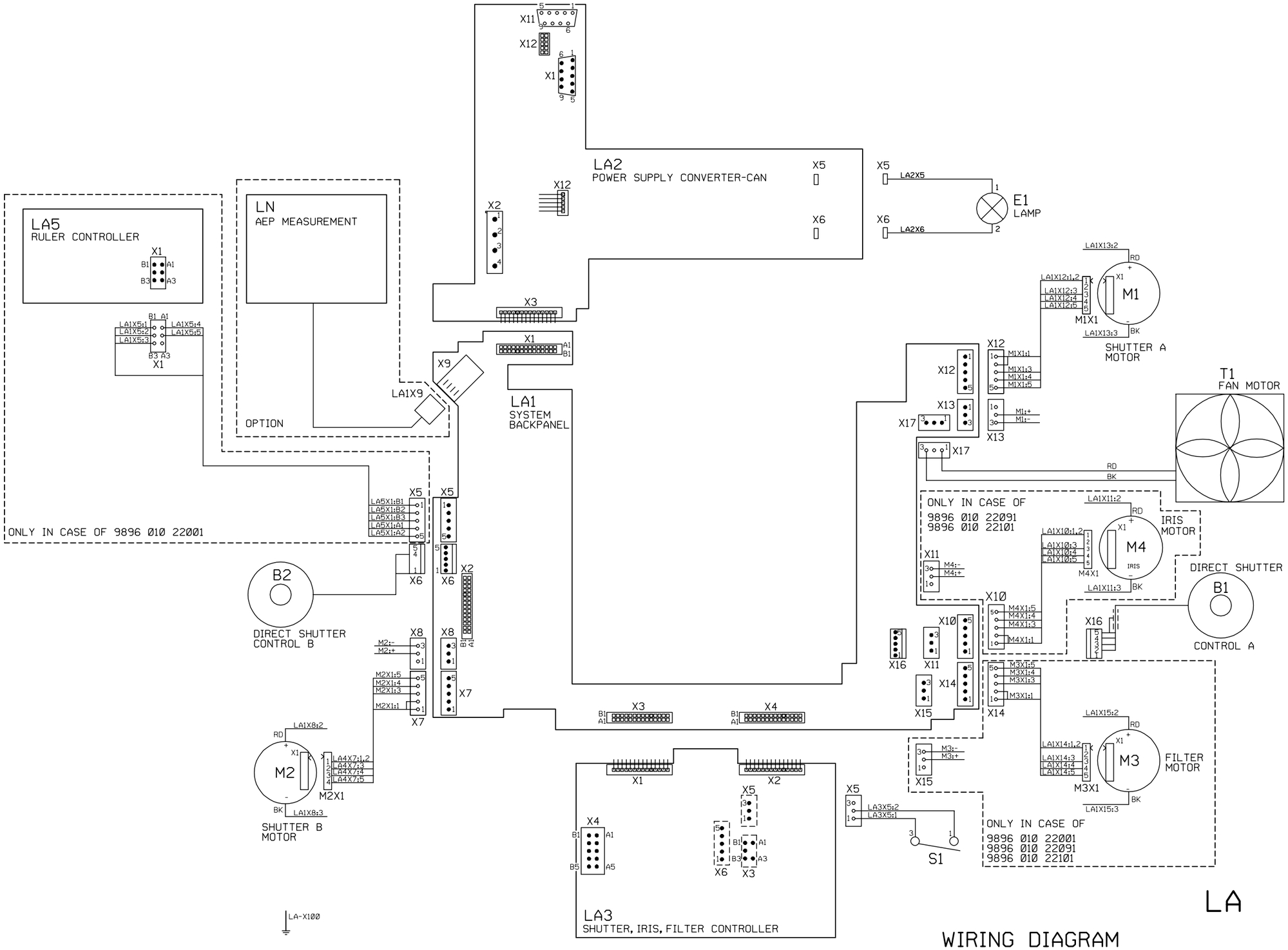
SIMPLIFIED DIAGRAM
X-RAY BEAM LIMITING DEVICE

9896 010 2200.
2201.
2209.
2210.

(Ø3.0)

Z1-2

1/03581



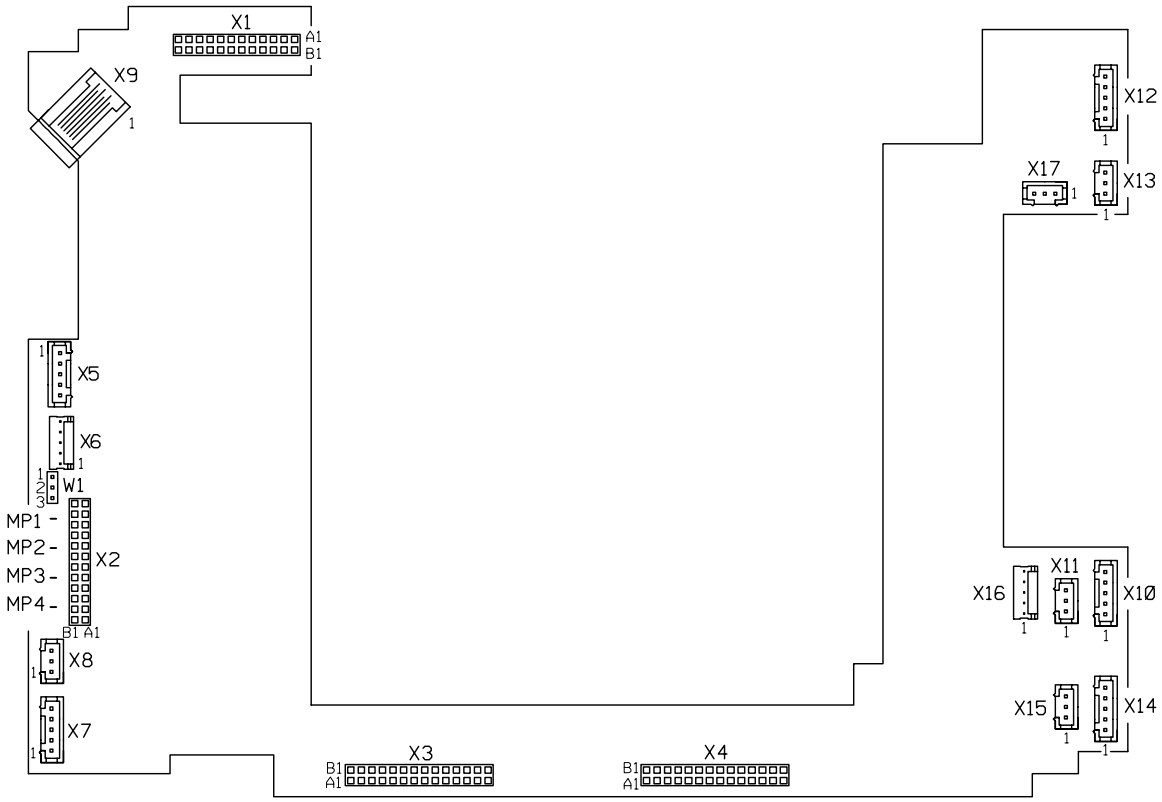
LA

WIRING DIAGRAM
X-RAY BEAM LIMITING DEVICE

9896 010 2200.
2201.
2209.
2210.

(Ø3.Ø)

Z2-1



MP1 : 0V/2
MP2 : +24V
MP3 : 0V
MP4 : +5V

W1:1-2 : FRONTAL
W1:2-3 : LATERAL

4522 167 0200.

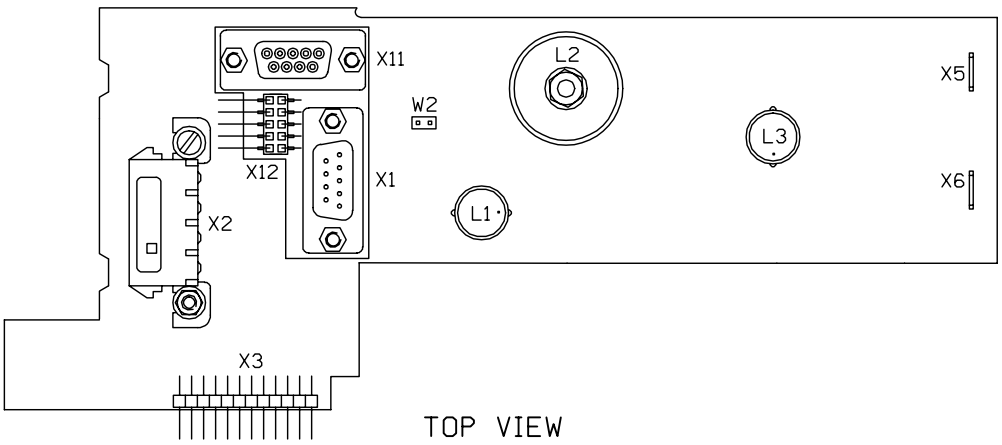
LA1

SERVICE REFERENCE SHEET SYSTEM BACKPANEL (SYBA)

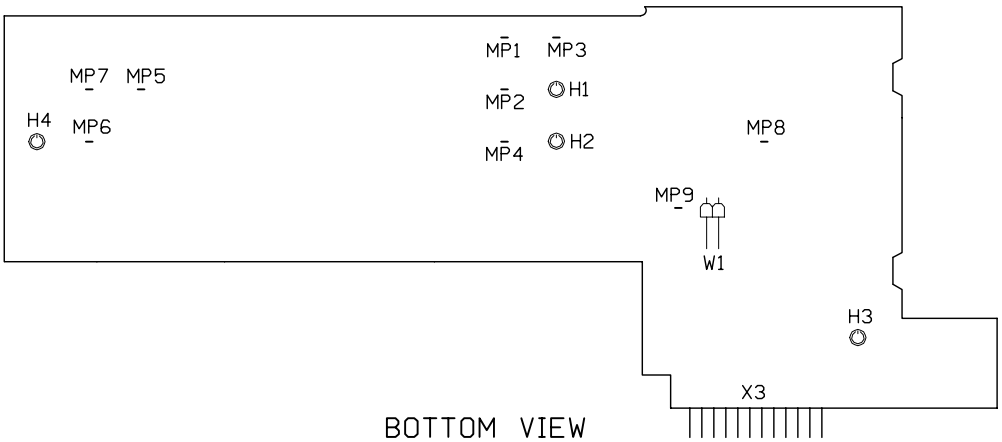
2200.
2201.
9896 010 2209.
2210.

(03.0)

1/03581



TOP VIEW



BOTTOM VIEW

MP1 : 0V/2
MP2 : +24V
MP3 : 0V
MP4 : +5V
MP5 : 0V/3
MP6 : LIGHT_ON
MP7 : +12V
MP8 : 0VCANSYS
MP9 : +12VCANSYS

H1 : +24V
H2 : +5V
H3 : +5VCANSYS
H4 : +12V

W1 : END NODE
W2 : FOR DEVELOPMENT ONLY (JUMPER NOT MOUNTED)

4522 166 1024.

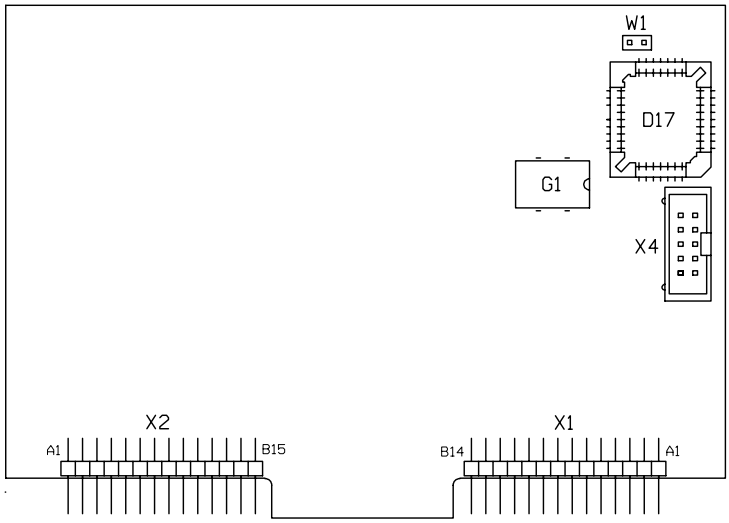
LA2

SERVICE REFERENCE SHEET POWER SUPPLY (PSC-CAN)

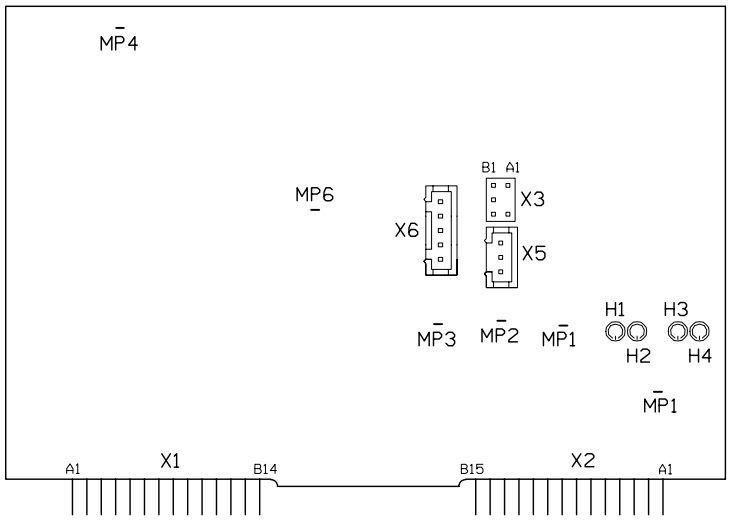
9896 010 2200.
2201.
2209.
2210.

(03.0)

1/03581



TOP VIEW



BOTTOM VIEW

MP1 : 0V/2
MP2 : +24V
MP3 : 0V
MP4 : +5V
MP6 :

H1 : +5V PRESENT
H2 : PCB NOT OK
H3 : CONNECTED HW NOT OK
H4 : CAN-NETWORK NOT OK

W1 : FOR DEVELOPMENT ONLY (JUMPER NOT MOUNTED)

4522 167 0202.

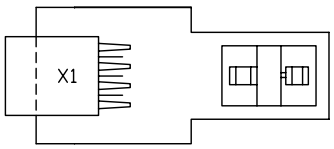
LA3

SERVICE REFERENCE SHEET SHUTTER/IRIS/FILTER (SIFLCO)

9896 010 2200.
2201.
2209.
2210.

(03.0)

1/03581



ONLY ON 9896 010 22001

4522 167 0262.

LA5

SERVICE REFERENCE SHEET RULER CONTROLLER (RUCO)

9896 010 2200.
2201.
2209.
2210.

(03.0)

1/03581